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(54) **MACCHINA DI COMPATTAZIONE DI TESSUTI**

(57) Machine (10) for compacting fabrics (T), comprising a conveyor belt (11) closed in a loop and provided with at least one segment (11a) wound around a rotating cylinder (12) so as to form a contact zone (Z) in which said fabric (T) is pressed between the cylinder (12) and the conveyor belt (11).

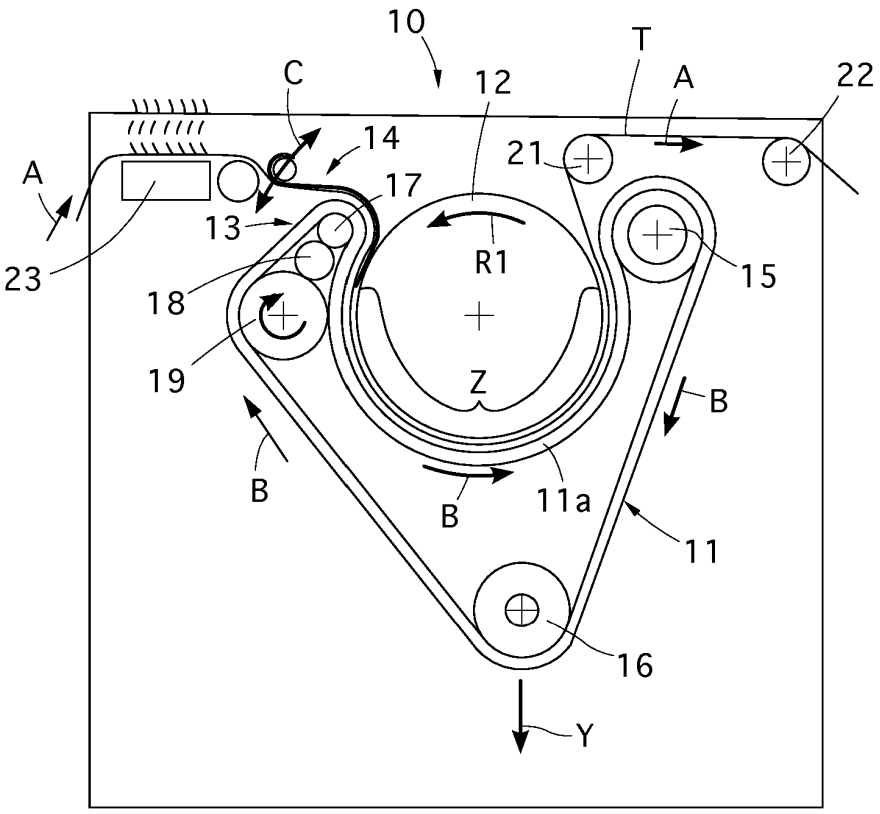

Fig. 1

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Description

[0001] The present invention concerns a machine for compacting fabrics, generally able to be used to compact portions of fabrics in a longitudinal direction, in particular during the fabric finishing operations.

[0002] The fabrics in question can be natural, synthetic, or a combination of both. These fabrics can also be made of canvas, also called "shuttle", that is, produced by crossing threads called warp and weft, respectively, or knitted. Machines that are used in the textile industry to compact continuous portions of fabric according to a preferential direction are known.

[0003] In particular, the fabrics to be compacted are made of long continuous strips in which the textile fibers are disposed intertwined with each other, forming a weft and warp, according to the inter-distances, or so-called steps, defined between the needles of the weaving machines' frames.

[0004] Typically, the compacting operation is necessary to bring together the textile fibers that during the intermediate washing, dyeing, etc. work have been subjected to an abnormal elongation in the longitudinal direction, and which therefore make the fabric itself unstable, unless it is treated with a compacting machine before it is sent to packaging. The purpose of compaction is therefore to make the fabrics stable and structurally more compact and, consequently, less floppy and subject to shortening after subsequent washes, thus preserving the original size set in the packaging, both in width as well as in length. Apparatuses and methods for compacting fabrics are known in the state of the art. Some examples of such apparatuses and methods known in the art are "Sanfor" type compacting machines and felt compacting machines.

[0005] Known compacting machines comprise a conveyor belt closed in a loop around a plurality of rollers, at least one of which is motorized, and provided with a segment at least partly wound around a heated rotating cylinder in which the fabric is pressed between the cylinder and the conveyor belt. The winding segment of the conveyor belt around the cylinder defines a zone of stabilization of the fabric.

[0006] In "Sanfor" type machines the conveyor belt is made of rubber, while in felt machines it is made, precisely, of felt.

[0007] "Sanfor" type machines, which implement a "wet" compacting method in which it is provided to wet or humidify the fabric, have the disadvantage of not being able to work delicate fabrics, such as viscose fabrics for example, without compromising their quality because steam and water can damage these fabrics.

[0008] Felt compacting machines have different limitations, mainly due to surface degradation and soiling of the felt with fabric residues, and therefore to the need for frequent maintenance, for example by means of restoration interventions by brushing the felt's surface in contact with the fabric. It is evident that frequent maintenance operations, and therefore machine downtime, lead to times and costs that affect overall efficiency.

[0009] Another disadvantage of the felt conveyor belt is that because of its slippery external surface it does not exert sufficient grip on the fabric during its passage in the zone interposed between the cylinder and the conveyor belt, allowing a partial sliding thereof.

[0010] This sliding is a particularly unwelcome effect for operators, since the principle of compaction is based on the firm adherence of the fabric to the conveyor belt. To perform an effective compaction it is necessary to make the fabric adhere to the conveyor belt so as to force the fabric to follow the peripheral speed variations of the conveyor belt.

[0011] In particular, at entry to the stabilization zone, the geometry of the machine is such that the fabric is first made to follow a bend around an entry roller, and then a counter-bend around the heated rotating cylinder.

[0012] To guarantee the correct adhesion of the fabric to the conveyor belt made of felt, in known compacting machines there is provided, upstream of the stabilization zone, an introduction device, configured as a polytetrafluoroethylene (PTFE) sheet, which exerts a pressure on the fabric, pressing it against the conveyor belt.

[0013] In this way, the fabric is kept adherent to the conveyor belt by the introduction device, until the fabric itself is interposed between the conveyor belt and the heated rotating cylinder in the stabilization zone.

[0014] Another type of apparatus for compacting fabrics is described in EP 3.754.088, in which the conveyor belt is flexible and elastically extendable, and at least two independently motorized rollers are provided, one for driving and one for braking, which impart their different speeds of rotation to the belt so as to determine a selective elongation in one segment of the belt, followed by a subsequent shortening in correspondence with the segment wound around the heated rotating cylinder. The latter presses the fabric against the conveyor belt so that in the zone where the belt shortens, the same effect also occurs in the textile structure of the transported fabric which, therefore, shortens accordingly, compacting its fibers.

[0015] EP 3.754.088 comprises one or more interposition belts, which are disposed between the conveyor belt and the heated cylinder in order to prevent their direct contact. On the one hand, this solution aims to protect the conveyor belt from the heat emitted by the cylinder to prevent deterioration of the belt and extend its useful life and, on the other hand, it is configured as a system for reducing the friction between the conveyor belt and the cylinder.

[0016] The purpose of the present invention is to provide a compacting machine which can overcome some of the disadvantages of the state of the art. In particular, a purpose of the present invention is to provide a machine for compacting fabrics which allows to introduce the fabric between the heated rotating cylinder and the conveyor belt in a more effective way, ensuring a greater grip of

the fabric to the conveyor belt itself.

[0017] Another purpose of the present invention is to provide a machine for compacting fabrics in which the conveyor belt is not affected by the problems of surface degradation and soiling with fabric residues typical of felt conveyor belts used in a type of apparatuses for compacting fabrics known in the sector. Another purpose of the present invention is to provide a machine for compacting fabrics which allows to obtain a more dimensionally stable fabric, in particular in the warp direction, and which therefore has higher quality standards.

[0018] Another purpose of the invention is an apparatus for finishing fabrics in which it is provided to use at least one compacting machine according to the present invention located downstream of a stretching machine, in particular equipped with pin chains.

[0019] In accordance with the above purposes, a machine for compacting fabrics according to the present invention comprises a conveyor belt closed in a loop, mobile along a path of advance and provided with at least one segment adjacent to a rotating cylinder so as to form a contact zone, in particular an arc of a circle, in which the fabric is pressed between the rotating cylinder and the conveyor belt.

[0020] According to one aspect, the conveyor belt is made of an elastically deformable material, for example an elastomer such as rubber or suchlike, and at entry to the contact zone the conveyor belt cooperates with a device for introducing the fabric which exerts a pressure on the fabric, making it adhere to the conveyor belt, thus constraining it to follow its variations in speed.

[0021] At entry to this contact zone there is provided a bending device comprising a plurality of rollers and configured to make the conveyor belt perform a bend. According to one aspect, the machine comprises a movement roller configured to make the conveyor belt advance along the path of advance with substantially uniform speed.

[0022] According to one aspect, the bending device comprises a deforming roller around which the conveyor belt is partly wound, so that the portion of the conveyor belt in contact with the deforming roller deforms locally in such a way as to determine a localized elongation, thanks to which the conveyor belt, in correspondence with the bending device, advances along the path of advance with a peripheral speed greater than said uniform speed.

[0023] In this way, the conveyor belt has a higher peripheral speed than when it is in a substantially rectilinear position, therefore when it is wound around the rotating cylinder, assuming a slight counter-bend, the peripheral speed of the conveyor belt decreases by a percentage varying between 15 and 20%, with this speed variation dragging the fabric which is kept adhering to the conveyor belt itself by the introduction device, consequently causing it to compact in the longitudinal direction.

[0024] Advantageously, thanks to the use of the elastomer conveyor belt, for example rubber or suchlike, in combination with the introduction device, it is possible to obtain an extremely effective and precise compacting machine. Furthermore, the rubber conveyor belt is not subject to the degradation and soiling phenomena typical of felt belts, and above all thanks to its high surface adhesion coefficient (grip) it does not allow the fabric to slip, thus allowing to achieve higher degrees of compaction compared to those achievable with felt belts of the prior art.

[0025] According to another aspect, the conveyor belt can be made of natural rubber or synthetic rubber or silicone rubber.

[0026] According to another aspect, the thickness of the conveyor belt varies from about 8 mm to about 40 mm, advantageously from about 20 mm to about 25 mm.

[0027] According to another aspect, the introduction device is made by means of a sheet of polymeric material such as polytetrafluoroethylene (PTFE). According to another aspect, the introduction device is made by means of a sheet of synthetic aramid fiber, made slippery by spreading a layer of PTFE on the surface.

[0028] According to another aspect, the thickness of the introduction device varies from about 0.1 mm to about 3 mm.

[0029] According to another aspect, the plurality of rollers of the bending device comprises at least one counter-roller in contact with the deforming roller, on which the latter rests during their rotation around a first axis of rotation and a second axis of rotation, respectively, which are parallel to each other. Substantially, the counter-roller therefore acts as support for the deforming roller, whereby its bending resistance is advantageously increased, thus making it possible to create a deforming roller with a decidedly smaller diameter than that normally provided in deforming rollers used for similar functions in known compacting machines equipped with felt conveyor belt. The choice of a smaller diameter for the deforming roller allows to bend and deform the conveyor belt more. This greater deformation is achievable thanks to the fact that the conveyor belt made of elastomeric material adheres perfectly to the deforming roller, practically with a "sucker effect", and therefore without any slipping on this roller, and therefore assuming a high deformation, dictated by the considerable bend, achievable thanks to the fact that the diameter of the deforming roller is very small. This deformation is transmitted to the fabric entering the contact zone between the rotating cylinder and the conveyor belt, thus significantly increasing the effectiveness of the compacting action. Substantially, the bending radius of the conveyor belt around the deforming roller being much smaller than the bending radii of the felts on the deforming rollers of the machines of the prior art determines a much greater difference in speed between the bending zone and the substantially rectilinear zone of the conveyor belt, with the effect of therefore achieving a greater compaction.

[0030] Considering that the compaction occurs due to speed differences in the peripheral surface of the con-

veyor belt, the compaction is greater the smaller the bending radius around the deforming roller and the greater the grip of the fabric on the conveyor belt itself.

[0031] According to another aspect, the plurality of rollers of the bending device comprises a very robust support roller, with a diameter suitable to support the entire unit consisting of the deforming roller and the counter-roller without any inflexions. The support roller is in contact with the counter-roller, on which the latter rests during their rotation around the second axis of rotation and a third axis of rotation, respectively, which are parallel to each other and to the first axis of rotation.

[0032] According to another aspect, the extent of the localized deformation is a function of the diameter of the deforming roller, which is comprised between approximately 40 mm and 80 mm, in a preferential version equal to approximately 60-70 mm.

[0033] According to one aspect, the machine comprises a single movement roller and a tensioning roller comprising in turn a mechanical or hydraulic drive to exert an adjustable force on the conveyor belt in a substantially vertical direction. According to one aspect, the conveyor belt is closed in a loop around the bending device, the single movement roller and the tensioning roller. According to one aspect, the machine comprises a steamer device configured to humidify the fabric and make it more plastic, and disposed upstream of the bending device and the introduction device.

[0034] The invention also concerns an apparatus for finishing fabrics, comprising a first compacting operating module and at least a second compacting operating module, disposed downstream of the first module with reference to a direction of advance of the fabric, wherein the first module comprises the compacting machine as defined above and wherein the second module comprises a rotating cylinder and a felt compacting belt cooperating with the respective rotating cylinder, closed in a loop on a corresponding drive roller which drives it in movement and around additional return rollers.

[0035] According to one aspect of the present invention, the first module and the second module are integrated into the same frame.

[0036] Another variant of the invention provides at least one fabric stretching machine, for example of the type with pin chains, located upstream of the compacting machine, and one or more felt compacting modules, disposed downstream of at least one machine for compacting fabrics as defined above, with reference to a direction of advance of the fabric.

[0037] Experimental tests carried out by the Applicant, in particular on knitted fabrics, have demonstrated that the compacting machine of the present invention allows to achieve a very high degree of compaction, even 50% higher than similar machines known in the art which have a felt conveyor belt, with the same thickness of the conveyor belt and diameter of the deforming roller comprised in the bending device.

[0038] The drawings of this document illustrate the characteristics described above, as well as additional ones, which will appear clear from the following description, provided by way of a non-limiting example, wherein:

- fig. 1 is a schematic lateral view of a machine for compacting fabrics according to the present invention;
- fig. 2 is an enlarged scale lateral view of a zone of the compacting machine of fig. 1;
- fig. 3 is a schematic front view of the compacting machine of fig. 1;
- fig. 4 is a schematic lateral view of a first embodiment of an apparatus for finishing fabrics comprising the machine of fig. 1;
- fig. 5 is a schematic lateral view of a second embodiment of an apparatus for finishing fabrics comprising the machine of fig. 1.

[0039] With reference to the attached drawings, see in particular fig. 1, a machine **10** for compacting fabrics **T** comprises a conveyor belt **11** closed in a loop and provided with at least one segment **11a** wound around a rotating cylinder **12** so as to form a contact zone **Z** corresponding to an arc of a circle, in which the fabric **T** is suitably pressed between the rotating cylinder **12** and the conveyor belt **11.**

[0040] The conveyor belt **11** is made of elastic material, such as rubber or suchlike, and a bending device **13** and an introduction device **14** are positioned in proximity to an entry side of the contact zone **Z,** which are configured to give the fabric **T** an arrangement suitable for entry into the contact zone **Z.**

[0041] The introduction device **14** and the bending device **13** are disposed close to each other, on opposite sides with respect to the conveyor belt **11,** in proximity to the entry side to the contact zone **Z.**

[0042] The rotating cylinder **12** is rotated by means of corresponding drive means in the direction **R1,** so as to drag the fabric **T** from an entry zone to an exit zone of the machine **10.** The fabric moves in a direction of advance **A.**

[0043] The rotating cylinder **12** is provided with heating means, suitable to bring the fabric **T** to the temperature desired for the compacting treatment provided. The heating temperature can for example be variable from about 80°C to about 220°C. The heating can be carried out by means of steam, electric resistors immersed in an oil bath inside the cylinder, infrared resistors or other. The conveyor belt **11** is in particular closed in a loop around the bending device **13,** a movement roller **15,** for example a motorized roller, and a tensioning roller **16,** for example with drive of the mechanical type with screw jack, with hydraulic system or other. The conveyor belt **11** then follows a closed loop path of advance, path of advance for short, indicated with reference **B,** along which it advances with uniform speed given by the rotation of the movement roller **15.**

[0044] The tensioning roller **16** applies a force adjust-

able in the direction **Y** (fig. 1) to tension the conveyor belt **11.** During use, the latter is kept tensioned even as it advances. The maximum tension applicable to the conveyor belt **11** is considerable, since it has to extend an elastomeric belt, typically made of rubber, having a certain thickness, and it can vary from 1 to 6 tons, so as to determine an elongation thereof by a percentage varying from 4 to 20% with respect to a resting configuration, in which the belt does not undergo any tension. The thickness of the conveyor belt **11** is comprised in a range from about 8 mm to about 40 mm and preferably from about 20 mm to about 25 mm.

[0045] The conveyor belt **11** is made of natural rubber, resistant to heat up to temperatures of about 80-90°C, or synthetic rubber, or even silicone rubber, resistant to temperatures of up to about 200-220°C. It is therefore possible to establish which type of rubber to use based on the heating temperatures provided for the rotating cylinder **12** and most suitable for the composition of the fabric to be treated.

[0046] The introduction device **14** (fig. 2) has a sinuous shape and can be adjusted toward or away from the bending device **13** substantially in the direction **C,** by means of suitable adjustment means, not shown. The adjustment means can be manual, electrically motorized and associated with an encoder, pneumatic, or other.

[0047] The introduction device **14** can be made with a sheet, preferably made of polymeric material such as polytetrafluoroethylene (PTFE) or suchlike, with characteristics such as to make it a very flexible material, with a low coefficient of friction and with high thermal and mechanical resistance.

[0048] Alternatively, the introduction device **14** can be made by means of a sheet of fabric of aramid synthetic fiber, for example Kevlar®, treated with surface spreading of a surface layer of PTFE.

[0049] This variant also has the same characteristics of high thermal and mechanical resistance.

[0050] The thickness of the sheet of the introduction device **14** can be variable from about 0.1 mm to about 3 mm, therefore it is advantageously extremely thin, resistant and not bulky.

[0051] The bending device **13,** see also fig. 3, comprises at least one deforming roller **17,** which faces the introduction device **14,** a counter-roller **18** and a support roller **19,** wherein the counter-roller **18** is interposed between the deforming roller **17** and the support roller **19.**

[0052] The deforming roller **17** substantially rests on the counter-roller **18.** The support roller **19** is in contact with the counter-roller **18.** The counter-roller **18** is located between the deforming roller **17** and the support roller **19,** and is substantially configured as a bearing which has the task of increasing the bending resistance of the bending device **13** and in particular of the deforming roller **17,** which in fact deforms the conveyor belt **11,** creates its bending and is subjected to the greatest stresses. Since the conveyor belt **11** is always held taut by the force applied in the direction **Y** by the tensioning roller **16,** it can be easily understood how the deforming roller **17** is subjected to a continuous downward force, which is then unloaded onto the counter-roller **18** and onto the support roller **19.** This force can cause a downward bending of the deforming roller **17,** in particular in correspondence with its center.

[0053] This inflection phenomenon is all the more evident the more the diameter of the roller is reduced and its length increased. Considering that typical length measurements of this deforming roller reach even up to 3 meters (fig. 3), it is clear that this inflection phenomenon must be counteracted.

[0054] Thanks to the fact that the deforming roller **17** is in contact with the counter-roller **18,** it can be made with a much smaller diameter than known rollers, while withstanding much greater bending stresses. This is possible thanks to the fact that the counter-roller **18** acts as a bearing, and therefore provides a contrasting constraint with respect to the downward bending to which the deforming roller **17** is subjected due to the pull exerted on it by the tensioned conveyor belt **11.**

[0055] The conveyor belt **11** can therefore perform a narrower bend, and therefore with a reduced bending radius, so as to cause a localized lengthening of the conveyor belt **11,** as visible in the enlargement of fig. 2, where the segment of conveyor belt **11** that deforms by winding around the deforming roller **17** is indicated with the letter Δ.

[0056] Measurements and experimental tests carried out by the Applicant have revealed that the linear length of the deformed segment is greater, even by 15%, than the undeformed length of this same segment in the event that the diameter of the deforming roller **17** is equal to 90 mm, or even 25% greater than the undeformed length of this same segment in the event that the diameter of the deforming roller **17** is equal to 70 mm. In both cases, the thickness of conveyor belt **11** is 21 mm. This increases the theoretical compacting power by up to 20% more than solutions known in the art.

[0057] This greater localized elongation amplifies the difference in peripheral speed between the bend segment in correspondence with the deforming roller **17** and the subsequent segment in which the counter-bend is substantially provided, in correspondence with the entry of the contact zone **Z.** In fact, due to the localized elongation, the conveyor belt 11 travels this bend segment with a much higher peripheral speed, even 25% higher, than the uniform speed with which the belt travels the contact zone **Z,** which is equal to the constant speed imparted to the conveyor belt **11** by the movement roller **15.**

[0058] The sudden decrease in the peripheral speed of the conveyor belt **11** between the bend segment around the deforming roller **17** and the entry of the contact zone **Z** significantly increases the compacting potential of the fabric **T,** which is caused by the speed reduction, since the fabric follows the conveyor belt **11,** being pressed against it by the introduction device **14.**

[0059] The deforming roller **17** can have a diameter comprised between 40 mm and 80 mm, in a preferential solution about 70 mm, which is significantly smaller than the minimum diameter of about 90 mm used in similar rollers of known compacting machines with conveyor belt made of felt.

[0060] This percentage difference in the diameter of the deforming roller **17,** together with the high adhesion of the rubber conveyor belt **11** that prevents slippage of the fabric **T** and the action of the introduction device **14** that keeps the fabric **T** pressed against the belt in the introduction zone, allows to achieve a better compacting action of the machine according to the invention compared to conventional machines made according to the state of the art, by a percentage that can reach even 50%.

[0061] The deforming roller **17,** the counter-roller **18** and the support roller **19** can be associated at the ends with an intermediate structure **38** by means of corresponding supports **39, 40** and **41** that allow them to rotate, which are provided for example with rolling bearings or suchlike.

[0062] This intermediate structure **38** can in turn translate, as shown schematically by the arrows **V** in fig. 3, by means of mechanisms not shown in the drawings, in order to move toward or away from the rotating cylinder **12,** thus allowing to move the entire unit toward or away from the rotating cylinder, and optimize the set-up of the entire fabric entry zone.

[0063] This operation of moving toward or away can be achieved by means of a mechanical screw system with manual command or with motor control and position detection encoder, or by means of a pneumatic or a hydraulic system, etc.

[0064] Before reaching the bending device **13** and the introduction device **14,** the fabric **T** passes through a steamer device **23,** used to humidify it and make it more plastic, and therefore disposed upstream of these devices with reference to the direction of advance **A** of the fabric **T.**

[0065] At the exit of the contact zone **Z** between the rotating cylinder **12** and the conveyor belt **11,** therefore substantially when compaction is complete, the fabric **T** is returned around return rollers **21** and **22** and then made to exit from the machine **10.**

[0066] Fig. 4 schematically shows a first embodiment of an apparatus for finishing fabrics **T,** indicated as a whole with reference number **20,** and comprising the machine **10** as described above. The apparatus **20** provides a machine **24** for stretching the fabric **T,** such as for example a so-called "lifter" with pin chains, of which only the end part is visible. The passage of the fabric from the stretching machine **24** to the compacting machine **10** can occur with the aid of a transport device **25,** to prevent tensions and therefore deformations on the fabric.

[0067] In the present apparatus **20,** the machine **10** can be combined with another compacting machine **26** configured according to the state of the art and therefore equipped with conveyor belts **27** and **28** made of felt and provided with two compacting modules **29** and **30** and a steamer device **31** located upstream thereof. The other machine **26** is located downstream of the present machine **10** and performs other steps of compacting and finishing the fabric **T.** Each compacting module **29** and **30** is provided with a corresponding rotating cylinder **32** and **33** cooperating with the corresponding conveyor belt **27** and **28,** which is driven by means of a corresponding drive roller **34** and **35** and returned around further return rollers **36** and **37.**

[0068] Fig. 5 schematically shows a second embodiment of an apparatus for finishing fabrics **T,** indicated as a whole with reference number **50,** and comprising the machine **10** as described above.

[0069] The apparatus **50** comprises two operating modules integrated in the same frame **49.**

[0070] In the first module (or lower module) **42** there is provided a portion of machine with rubber conveyor belt **11,** as described above, this machine portion being configured as the compacting machine **10.**

[0071] In the second module (or upper module) **43** there is provided a portion of machine configured according to the state of the art, and therefore equipped with a conveyor belt **47** made of felt, with a heated rotating cylinder **46** cooperating with the felt conveyor belt **47,** driven by a corresponding drive roller **44** and returned around further return rollers **45.**

[0072] The upper module **43** is located downstream of the lower module **42** with reference to the direction of advance **A** of the fabric, and carries out another step of compacting and stabilizing the fabric **T,** proving to be particularly suitable for the finishing of soft fabrics, such as plush fabric, etc.

[0073] The passage of the fabric from the lower module **42** to the upper module **43** occurs by resting the fabric on a return roller **48** equipped with a load cell, which synchronizes the upper module **42** with the lower module **43,** imparting the minimum possible tension to the fabric in order to prevent any deformations thereof.

[0074] In this version of the apparatus **50,** the fabric **T** can only transit in the first module **42,** or in both modules **42, 43.** A dashed line in the drawing represents the fabric **T** exiting from the first module **42,** without being subjected to compaction work in the second module **43.** A solid line, on the other hand, represents the fabric **T** exiting from the second module **43,** after having passed through both operating modules. It is clear that these are two different modes of operation of the apparatus **50,** one alternative to the other.

[0075] The present machine **10** for compacting fabrics, including the possible variants illustrated in the finishing apparatuses **20** and **50,** therefore proves to be extremely efficient and extremely flexible, and also capable of quickly performing a compacting process that improves the mechanical properties of the fabric, making it stable, resistant and with high quality standards. In practice, it has been verified that the invention achieves the intended purposes.

Claims

1. Machine (10) for compacting fabrics (T), comprising a conveyor belt (11) closed in a loop, mobile along a path of advance (B) and provided with at least one segment (11a) adjacent to a rotating cylinder (12) so as to form a contact zone (Z) in which said fabric (T) is pressed between said rotating cylinder (12) and said conveyor belt (11), wherein said conveyor belt (11) is made of elastically deformable material, such as rubber or suchlike, and in proximity to an entry side of said contact zone (Z) there are positioned a bending device (13) comprising a plurality of rollers (17, 18, 19) and configured to make said conveyor belt (11) perform a bend at entry to said contact zone (Z) and an introduction device (14) cooperating with said conveyor belt (11) to exert a pressure on said fabric (T) causing it to adhere to said conveyor belt (11), thus constraining it to follow its variations in peripheral speed, **characterized in that** it comprises a movement roller (15) configured to make said conveyor belt (11) advance along said path of advance (B) with substantially uniform speed and **in that** said plurality of rollers (17, 18, 19) comprises a deforming roller (17) on which said conveyor belt (11) is wound so that the portion of the conveyor belt (11) in contact with the deforming roller (17) deforms locally in such a way as to determine a localized elongation of said portion of the conveyor belt (11) thanks to which in correspondence with the bending device (13) the conveyor belt (11) advances along the path of advance (B) with a peripheral speed greater than said uniform speed.

2. Machine (10) as in claim 1, **characterized in that** said conveyor belt (11) is made of natural rubber or synthetic rubber or silicone rubber.

3. Machine (10) as in claim 1 or 2, **characterized in that** the thickness of said conveyor belt (11) varies from about 8 mm to about 40 mm and in particular from about 20 mm to about 25 mm.

4. Machine (10) as in any claim hereinbefore, **characterized in that** said introduction device (14) is made by means of a sheet of polymeric material such as polytetrafluoroethylene (PTFE) or suchlike, or by means of an aramid fiber cloth coated with polytetrafluoroethylene (PTFE).

5. Machine (10) as in any claim hereinbefore, **characterized in that** the thickness of said introduction device (14) varies from about 0.1 mm to about 3 mm.

6. Machine (10) as in any claim hereinbefore, **characterized in that** said plurality of rollers (17, 18, 19) of said bending device (13) comprises at least one counter-roller (18) in contact with said deforming roller (17), on which the latter rests during their rotation around a first axis of rotation (X1) and a second axis of rotation (X2), respectively, which are parallel to each other.

7. Machine (10) as in claim 6, **characterized in that** said plurality of rollers (17, 18, 19) of said bending device (13) comprises a support roller (19) in contact with said counter-roller (18) on which the latter rests during their rotation around said second axis of rotation (X2) and a third axis of rotation (X3), respectively, which are parallel to each other and to said first axis of rotation (X1).

8. Machine (10) as in any claim hereinbefore, **characterized in that** the extent of said localized deformation is a function of the diameter of said deforming roller (17), which is comprised between approximately 40 mm and approximately 80 mm.

9. Machine (10) as in any claim hereinbefore, **characterized in that** it comprises a single movement roller (15) and a tensioning roller (16) comprising a mechanical or hydraulic drive to exert an adjustable force on said conveyor belt (11) in a substantially vertical direction (Y).

10. Machine (10) as in claim 10, **characterized in that** said conveyor belt (11) is closed in a loop around said bending device (13), said movement roller (15) and said tensioning roller (16).

11. Machine (10) as in any claim hereinbefore, **characterized in that** it comprises a steamer device (23) configured to humidify the fabric (T) and make it more plastic, and disposed upstream of said bending device (13) and said introduction device (14).

12. Apparatus (20; 50) for finishing fabrics, comprising a first compacting operating module (42) and at least a second compacting operating module (29, 30; 43), disposed downstream of said first module (42) with reference to a direction of advance (A) of the fabric (T), wherein said first module (42) comprises said compacting machine (10) as in any claim hereinbefore and wherein said second module (29, 30; 43) comprises a rotating cylinder (32, 33; 46) and a felt compacting belt (27, 28; 47) cooperating with the respective rotating cylinder (32, 33; 46), closed in a loop on a corresponding drive roller (35, 37; 44) which drives it in movement and around additional return rollers (36, 37; 45).

13. Apparatus (20; 50) as in claim 12, comprising at least one fabric stretching machine (24) disposed upstream of said machine (10), with reference to said direction of advance (A) of the fabric (T), and a transport device (25) which carries the fabric (T) from said

fabric stretching machine (24) to said machine (10).

14. Apparatus (20; 50) as in claim 12 or 13, wherein said second module (29, 30) is configured as another machine (26) comprising one or more of said felt compacting modules (29, 30), disposed downstream with respect to said first module (42) with reference to said direction of advance (A) of the fabric (T).

15. Apparatus (20; 50) as in claim 12 or 13, wherein said second module (43) is integrated into a same frame (49) also comprising said first module (42); said second module (43) being disposed downstream with respect to said first module (42) with reference to the direction of advance (A) of the fabric (T).

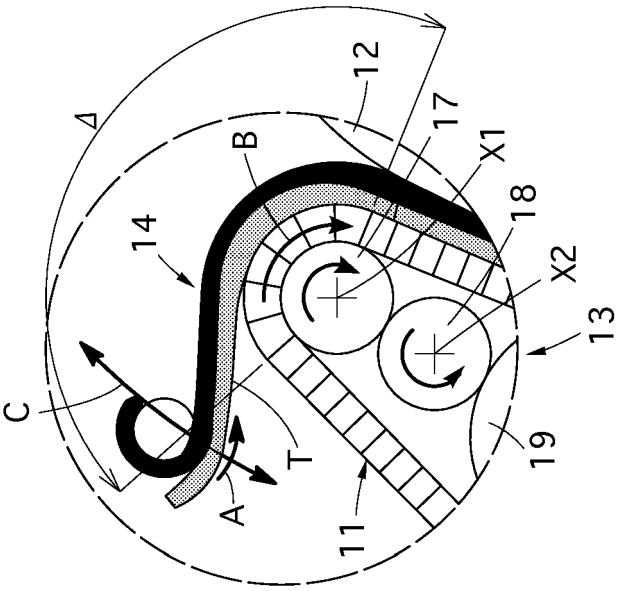
12
17
X1
18
X2
13
19
11
A
T
C
14
B
Δ

Fig. 2

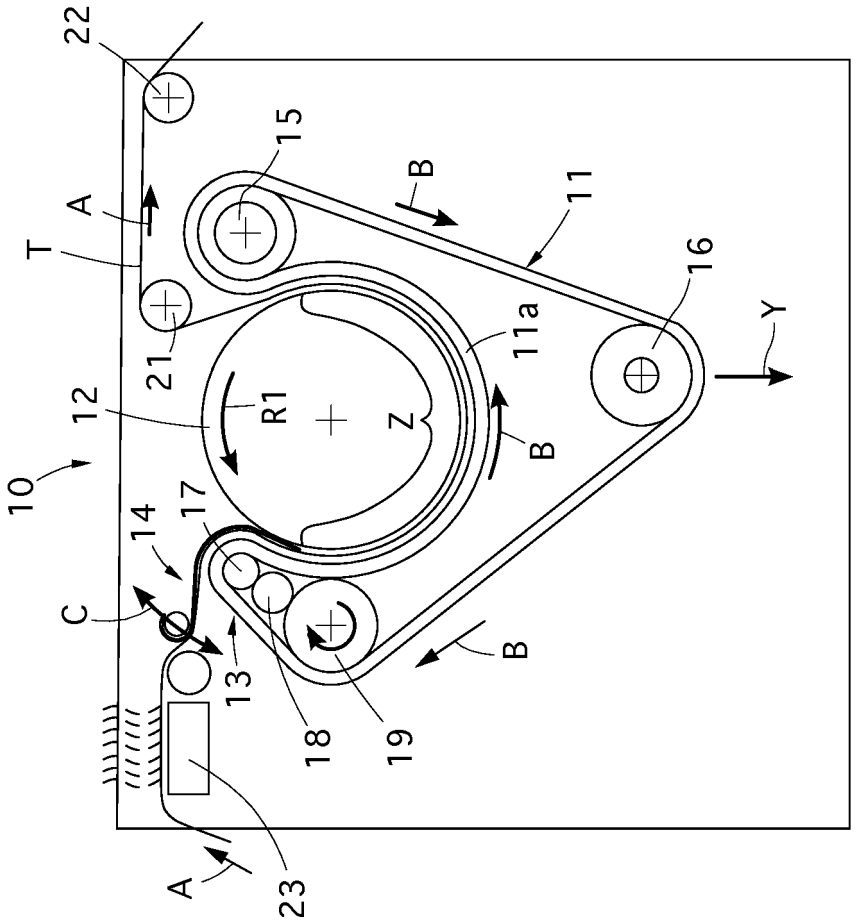
22
15
B
11
A
T
16
Y
21
11a
12
R1
Z
B
10
14
17
C
13
18
19
B
A
23

Fig. 1

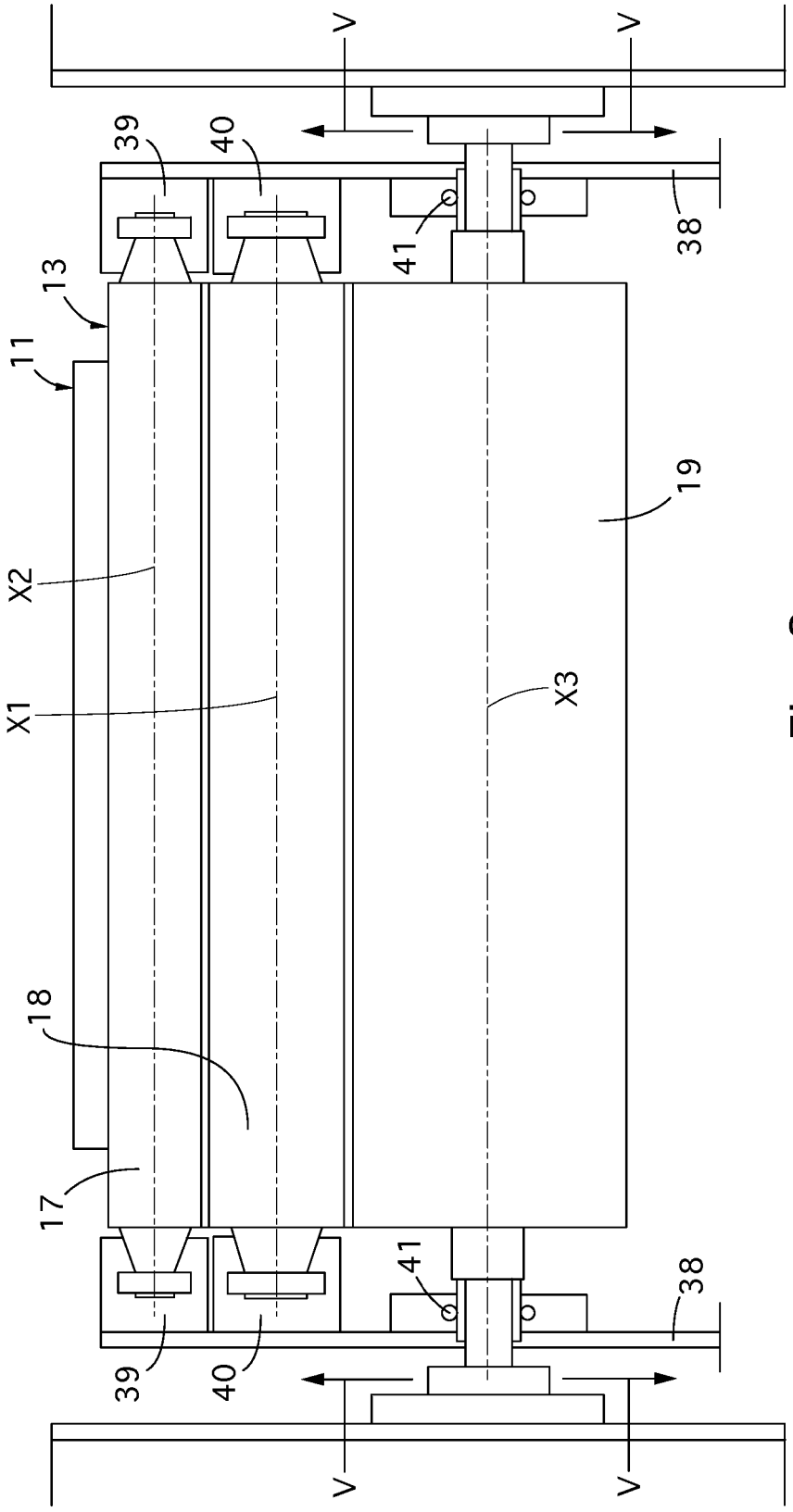

Fig. 3

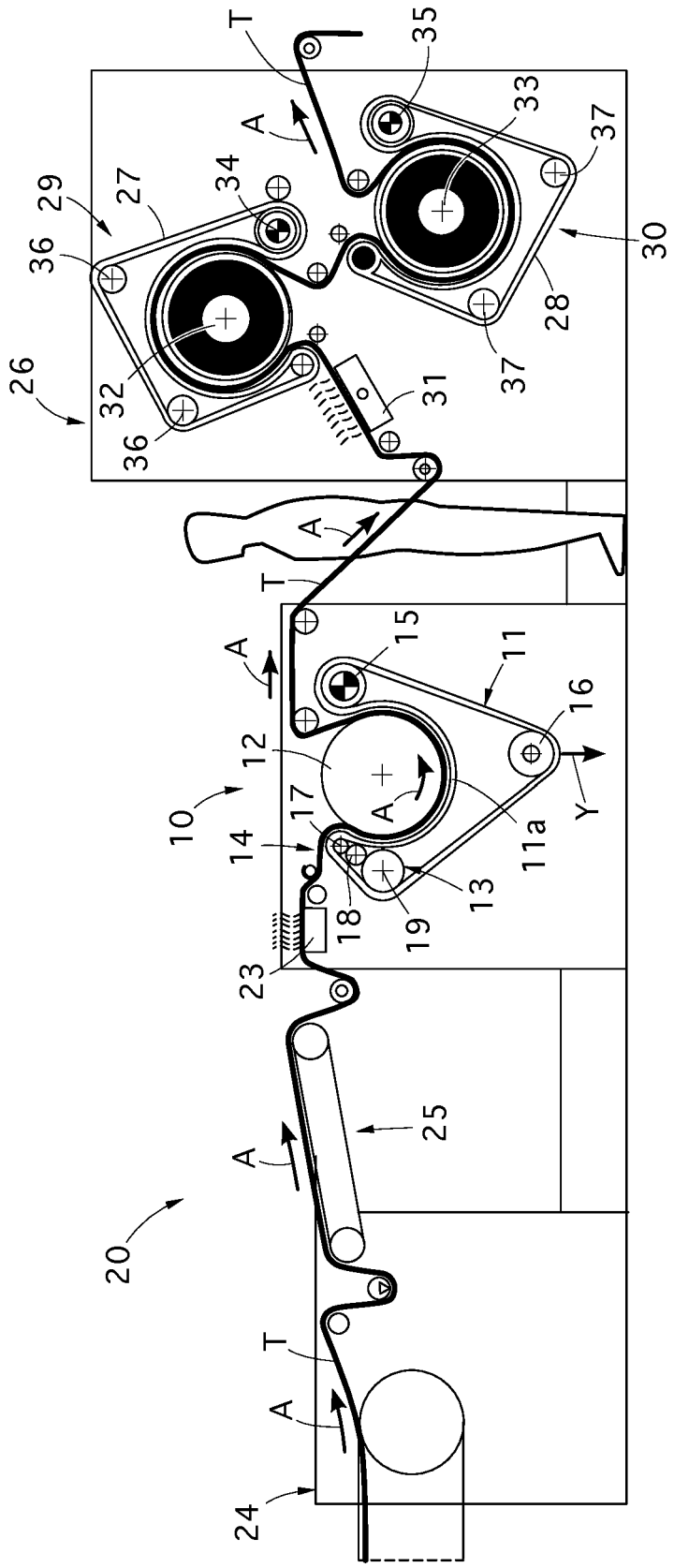
T
35
33
37
A
34
29
27
36
30
26
32
31
28
37
36
A
T
A
15
11
16
12
10
17
A
Y
14
11a
18
19
13
23
25
A
20
T
A
24

Fig. 4

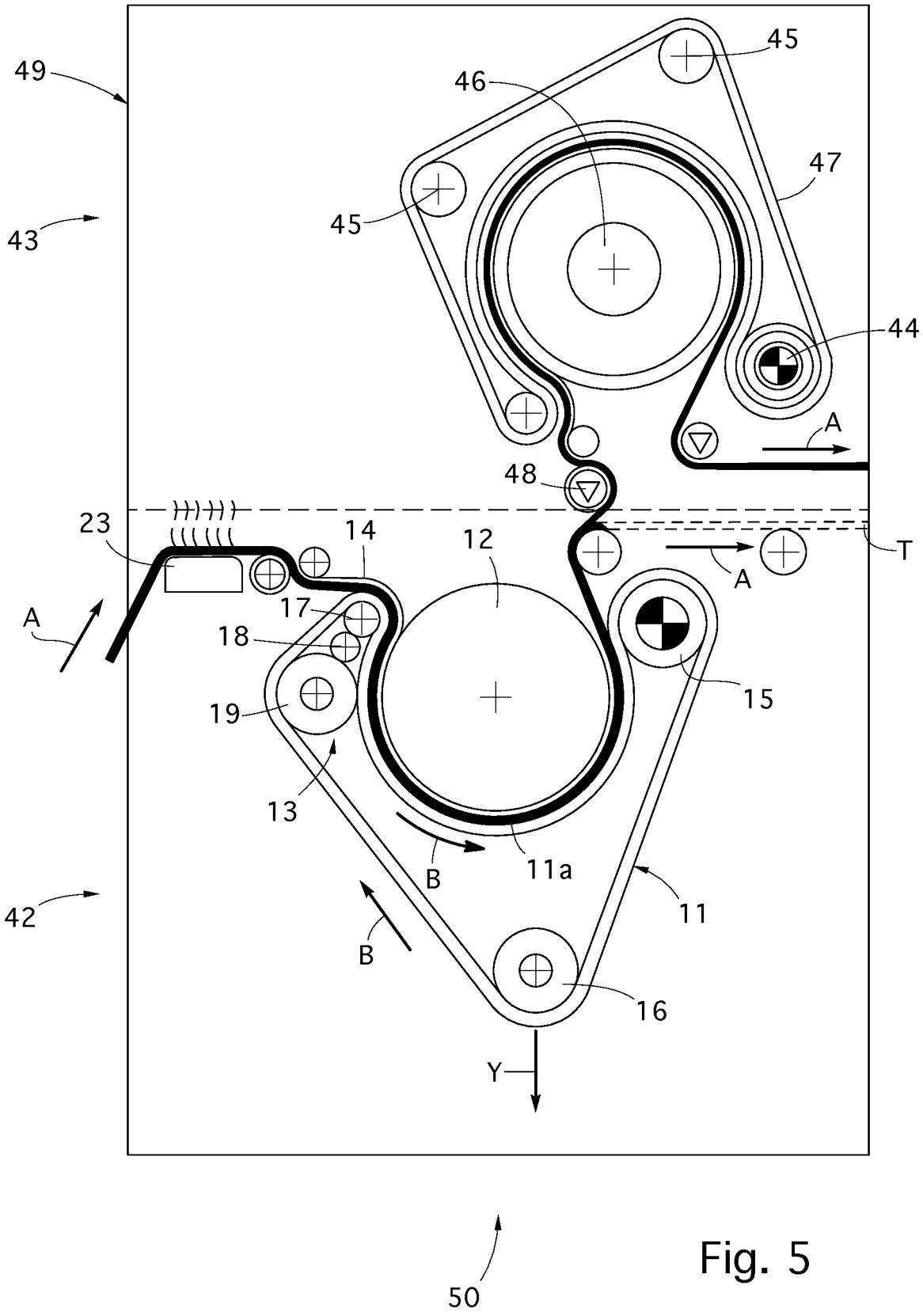
49
43
45
46
47
45
44
A
48
23
14
12
T
A
A
17
18
19
15
13
B
11a
42
B
11
16
Y
50

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 9941

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 607 132 B1 (RED CARPET S R L [IT]) 27 October 2021 (2021-10-27)	1,4,5,8, 13,14	INV. D06C21/00
Y	* paragraphs [0001] - [0007], [0032] - [0040], [0064]; claims; figures *	2,3,6, 9-12,15	ADD. D06C15/00 D06C15/02 D06C15/06
A		7	

Y,D	EP 3 754 088 A1 (SANTEX RIMAR GROUP S R L [IT]) 23 December 2020 (2020-12-23)	2,3	
A	* paragraphs [0001], [0031] - [0065], [0079] - [0092], [0137] - [0139]; claims; figures *	1,4-15	

Y	US 3 035 512 A (BEACHLER EDWARD D) 22 May 1962 (1962-05-22)	6	
A	* column 1, lines 12-52; column 3, lines 10-60; claims; figures *	1-5,7-15	

Y	EP 3 786 331 A1 (LAFER SPA [IT]) 3 March 2021 (2021-03-03)	9,10,12, 15	
A	* paragraphs [0001], [0002], [0069] - [0087]; claims; figures *	1-8,11, 13,14	TECHNICAL FIELDS SEARCHED (IPC)
	-----		D06C
Y	EP 1 357 217 A2 (MUZZI COSTRUZIONI MECCANICHE S [IT]) 29 October 2003 (2003-10-29)	11	
A	* paragraphs [0034] - [0045]; claims; figures *	1-10, 12-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 September 2024	Clivio, Eugenio

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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30-09-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3607132 B1	27-10-2021	CN 110546320 A	06-12-2019
		EP 3607132 A1	12-02-2020
		WO 2018185603 A1	11-10-2018
EP 3754088 A1	23-12-2020	CN 112095268 A	18-12-2020
		EA 202091249 A1	30-12-2020
		EP 3754088 A1	23-12-2020
		JP 2020204138 A	24-12-2020
		MA 53678 A	23-02-2022
US 3035512 A	22-05-1962	NONE	
EP 3786331 A1	03-03-2021	NONE	
EP 1357217 A2	29-10-2003	AT E358203 T1	15-04-2007
		DE 60312763 T2	24-01-2008
		EP 1357217 A2	29-10-2003
		IT MI20021678 A1	26-01-2004

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- EP 3754088 A **[0014] [0015]**