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(72) Inventor: **BIGOGNO, Mauro**
20126 MILANO (IT)

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(74) Representative: **Tansini, Elio Fabrizio**
Bugnion S.p.A.
Viale Lancetti 17
20158 Milano (IT)

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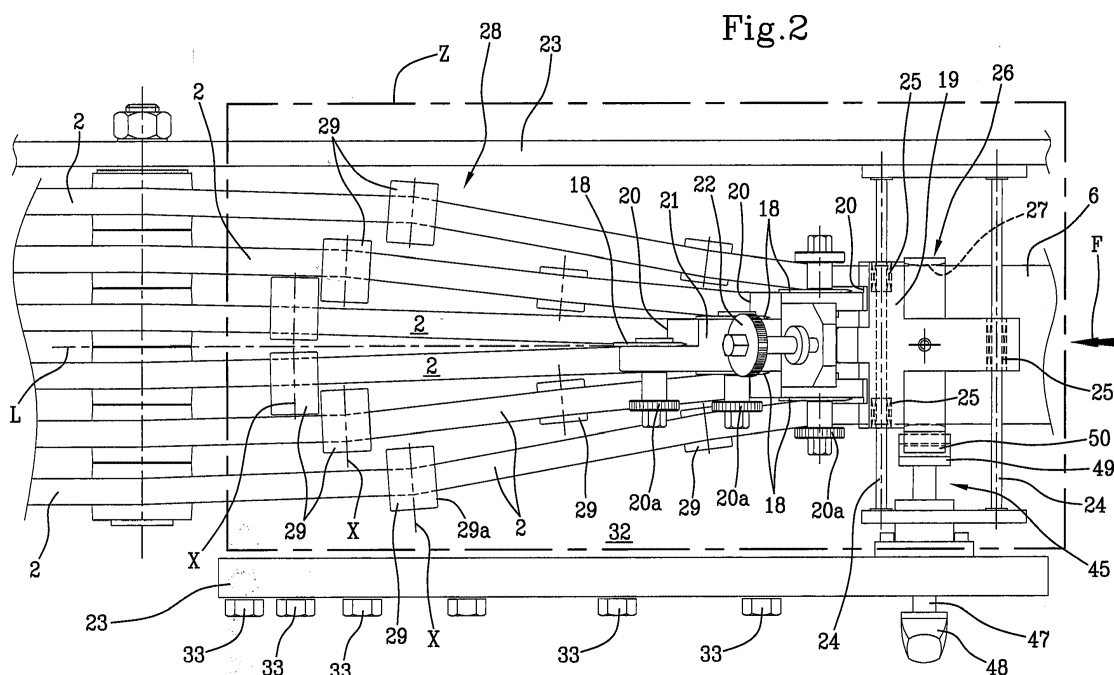
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(71) Applicant: **Pirelli Tyre S.p.A.**
20126 Milano (IT)

(54) **PROCESS AND PRODUCTION LINE FOR CONTROLLED COLLECTION OF CONTINUOUS STRIP-LIKE ELEMENTS FOR BUILDING TYRES**

(57) A continuous band (6) of elastomeric material comprising reinforcing cords (3), fed through an extrusion die (10), is cut for generating continuous strip-like elements (2). In the region of generation ("Z") of the continuous strip-like elements (2), guiding devices apply drift forces to each of the continuous strip-like elements (2)

to guide them along diverging trajectories. The drift forces are modulated by drive members (33) placed externally of said generation region ("Z") of continuous strip-like elements (2). Each continuous strip-like element (2) is collected on a respective reel (17).



Description

[0001] The present invention regards a process for controlled collection of continuous strip-like elements for building tyres. The invention also regards a production line that actuates the aforesaid process.

[0002] In building tyres, the use of elementary semi-finished products obtained from continuous strip-like elements is normally required; such elements comprise textile cords and/or metallic cords that are mutually parallel and incorporated in at least one layer of raw elastomeric material.

[0003] By way of example, this type of strip-like manufactured item can be cut into pieces to form strip-like elements to be employed in the manufacturing of a carcass ply, of a belt layer, or of another component of the tyre. As an alternative, a continuous strip-like element can be wound into coils disposed in side by side relationship around the circumferential extension of a tyre being processed, to form a reinforcement layer.

[0004] The manufacturing of the continuous strip-like elements normally takes place by means of a continuous process, starting from cords drawn from respective packages. The cords - whose number normally equals a multiple of the quantity provided in a single continuous strip-like element - are guided along paths converging towards a rubberizing unit. At the rubberizing unit, at least one layer of raw elastomeric material is applied on the set of cords disposed in a coplanar manner, so as to obtain a continuous rubberized band. The continuous rubberized band exiting from the rubberizing unit is conducted through a cutting unit comprising one or more knives which divide the band itself into two or more continuous strip-like elements.

[0005] In order to facilitate the mutual separation thereof, the continuous strip-like elements are moved away from the cutting unit along mutually diverging trajectories by means of suitable drift rollers, before being conducted to respective collection stations.

[0006] An exemplary embodiment of a known cutting unit is disclosed by JP S60-202057 A.

[0007] In order to meet the productivity needs of modern plants, the Applicant has studied the dynamic behaviour of semi-finished products in continuous band form translating at high speed along the production line.

[0008] The Applicant has thus been able to observe that, due to various factors that are hard to identify and control, the continuous band coming from the rubberizing unit occasionally carries out slight lateral movements during the advancement towards the cutting unit.

[0009] In high speed conditions, these movements tend to significantly alter the trajectory completed by the continuous strip-like elements translating away from the knives, with the risk of consequent breakage and interruption of the manufacturing cycle.

[0010] The Applicant has observed that an accurate control of these trajectories, in response to the occasional movements of the continuous band, can lead to significant

improvements of the state of the art, particularly in terms of productivity and final product quality.

[0011] The Applicant has perceived the manner of actuating the abovementioned control, by means of timely operations of restoration of the dynamic equilibrium of the lateral thrusts induced on the continuous strip-like elements translating away from the knives in the region of generation of the strip-like elements themselves.

[0012] More precisely, the Applicant has found that the execution of the restoration operations by means of drive members situated outside the region of generation of the continuous strip-like elements allows actuating an accurate control without interruption or decrease of productivity.

[0013] More particularly, according to a first aspect the invention regards a process for controlled collection of continuous strip-like elements for building tyres. Preferably, feeding a continuous band of elastomeric material comprising reinforcing cords is provided. Preferably, in a region of generation of continuous strip-like elements, it is provided to cut said continuous band, generating continuous strip-like elements.

[0014] Preferably, in said region of generation of continuous strip-like elements, it is provided to apply drift forces to each of said continuous strip-like elements, to guide them along diverging trajectories.

[0015] Preferably, it is provided to modulate said drift forces, by drive members placed externally of said region of generation of continuous strip-like elements. Preferably it is provided to collect each continuous strip-like element.

[0016] The Applicant deems that it is thus possible to increase the productivity along the production line of the continuous strip-like elements, without having to use sophisticated systems for inhibiting occasional lateral movements of the continuous band that advances at high speed towards the cutting unit.

[0017] By modulating the drift forces in the above-described manner, possible deviations of the trajectories completed by the continuous strip-like elements translating away from the knives are quickly corrected, without it being necessary to stop or slow down the production to execute the required corrections. The production lines can therefore always be utilised at maximum productivity, even during modulation operations. In a second aspect, the invention regards a production line for controlled collection of continuous strip-like elements for building tyres.

[0018] Preferably band feeding devices are provided, for feeding a continuous band of elastomeric material comprising reinforcing cords.

[0019] Preferably a cutting unit is provided, slidably engaging said continuous band and carrying knives operating through the continuous band for generating continuous strip-like elements therefrom.

[0020] Preferably guiding devices are provided, operating on said continuous strip-like elements to impart respective drift forces, guiding them along mutually diverging trajectories.

[0021] Preferably adjustment devices are provided for modulating said drift forces on said continuous strip-like elements.

[0022] Preferably at least one collection unit is provided for collecting each continuous strip-like element. Preferably said adjustment devices can be operated by drive members disposed externally of a region of generation of said continuous strip-like elements.

[0023] In at least one of the aforesaid aspects, one or more of the following preferred embodiment solutions can also be employed.

[0024] Preferably, the action of modulating the drift forces is carried out in response to transverse movements carried out by the continuous band.

[0025] It is thus possible to optimise the quality of the processing without it being necessary to guide the alignment of the continuous band advancing towards the knives with extreme precision.

[0026] In said generation region, at least one first deviation from the lying plane of the continuous band is preferably imposed to the continuous strip-like elements.

[0027] It is thus possible to move the continuous strip-like elements away from the knives immediately after the execution of the cutting and arrange more space for the housing of the guiding devices.

[0028] In the generation region, a second deviation directed laterally relative to the longitudinal extension direction of the continuous band can also be imposed to each continuous strip-like element.

[0029] This lateral deviation causes the desired spreading apart of the trajectories of the continuous strip-like elements along respectively diverging trajectories. Preferably the first and the second deviations can be imposed simultaneously.

[0030] In the generation region, at least one third deviation towards a lying plane of the continuous band can also be imposed to the continuous strip-like elements. Preferably the continuous strip-like elements, following the third deviation, are brought into mutual-coplanarity relationship.

[0031] The continuous strip-like elements, disposed in a coplanar manner with respect to each other and laterally separated from each other, are thus adapted to be simultaneously engaged by a drive unit and to be conducted to successive treatments stations along the production line.

[0032] The drift forces can be preferably generated by the passage of the continuous strip-like elements against drift rollers.

[0033] The generation of the drift forces can thus be attained by means of structurally simple, inexpensive and highly reliable components.

[0034] More particularly, the action of modulating the drift forces can be carried out by rotating at least one of said drift rollers around a correction axis perpendicular to a rotation axis thereof.

[0035] It is thus possible to control the intensity of the drift forces with simple, inexpensive and highly reliable

components.

[0036] The action of modulating the drift forces can be carried out in response to a notification signal.

[0037] Thus, the timeliness of operation is facilitated for the purpose of correcting the drift forces.

[0038] More particularly, the following actions can be provided for: comparing the position of a diverging stretch of at least one of said n continuous strip-like elements relative to a preset theoretical reference position; and emitting a notification signal when the difference between the position of the diverging stretch and the theoretical reference position exceeds a predetermined tolerance threshold.

[0039] In such a manner, a constant control of the correct position of the continuous strip-like elements is attained, facilitating timely correction operations.

[0040] The cutting action can be preferably executed simultaneously along the respectively opposite edges of the continuous band in order to generate pairs of continuous strip-like elements.

[0041] Preferably, said pairs of continuous strip-like elements are generated in succession starting from outer side edges of the continuous band.

[0042] In such a manner, an effective generation and separation of the continuous strip-like elements from the continuous band is attained.

[0043] The action of laterally translating a carriage carrying knives for following transverse movements of the continuous band can also be preferably executed.

[0044] A precise execution of the cutting is thus facilitated, due to a correction of the relative positioning between the knives and the continuous band following undesired transverse movements of the latter.

[0045] Preferably the action of translating the carriage takes place by effect of transverse thrust forces induced by transverse movements of the continuous band.

[0046] In such a manner, a structural and functional simplification of the system is obtained, due to a spontaneous alignment of the knives with respect to the continuous band.

[0047] The action of correcting the relative positioning between the continuous band and the knives during translation of the continuous strip-like elements can also be provided.

[0048] It is thus possible to restore the correct execution of the cutting in case of malfunctioning.

[0049] Said corrections are preferably carried out by imposing transverse movements to said knives with respect to the drift rollers against which the continuous strip-like elements pass.

[0050] The correction of the relative positioning between the continuous band and the knives is therefore attainable with simple and reliable equipment.

[0051] The transverse movements can be preferably actuated by means of an actuating arm that is disengaged from the cutting unit when correction has occurred.

[0052] A precise execution of the cutting is thus facilitated. Indeed, the cutting unit disengaged from the actu-

ating arm is facilitated in following the spontaneous transverse movements of the continuous band.

[0053] The action of feeding said continuous band can preferably comprise: feeding continuous reinforcing cords longitudinally translating through an extrusion die; applying at least one raw elastomeric layer onto the continuous reinforcing cords translating through the extrusion die.

[0054] Preferably each continuous strip-like element is collected on a respective reel separately from the other continuous strip-like elements.

[0055] Preferably said continuous band is fed at a speed included between about 1 m/s and about 3 m/s.

[0056] Still more preferably said continuous band is fed at a speed included between about 1.5 m/s and about 2.5 m/s. The guiding devices preferably impose, to said continuous strip-like elements, at least one first deviation from the lying plane of the continuous band. The guiding devices preferably impose, to said continuous strip-like elements, at least one second deviation directed laterally relative to the longitudinal extension direction of the continuous band. Preferably the guiding devices impose, to said continuous strip-like elements, at least one third deviation towards a lying plane of the continuous band. The continuous strip-like elements, following the third deviation, are preferably brought into mutual-coplanarity relationship.

[0057] The guiding devices preferably comprise drift rollers, provided for operating in contact relationship with said continuous strip-like elements.

[0058] Preferably each drift roller can have an operative surface with convex profile operating in contact relationship on the respective continuous strip-like element.

[0059] Preferably, each drift roller is rotatably idle.

[0060] Each drift roller is rotatably supported according to a rotation axis inclined to a direction perpendicular to a longitudinal extension direction of a stretch of the continuous strip-like element upstream of the drift roller itself.

[0061] Such inclination facilitates the generation of the desired drift forces.

[0062] For each continuous strip-like element produced by the cutting unit, at least two drift rollers are preferably provided which are mutually aligned along a trajectory diverging from a longitudinal mid-line of the continuous band.

[0063] Each drift roller is preferably positionable around a correction axis perpendicular to a rotation axis thereof.

[0064] In a preferred embodiment, each drift roller is rotatably supported by a rod around said correction axis.

[0065] The adjustment devices preferably comprise a transmission lever operating on said rod.

[0066] The transmission lever comprises a lever radially projecting with respect to the correction axis and a drive arm constrained to the lever.

[0067] The drive members preferably comprise a first threaded element rotatably supported externally of said

generation region.

[0068] Thus, excellent accuracy can be attained in regulating the intensity of the drift forces, since high angular rotations of the first threaded element correspond with micrometric movements of the drift roller around the correction axis.

[0069] The first threaded element can be operatively engaged with a second threaded element carried by the drive arm. The first threaded element is preferably engaged with a support structure of the cutting unit. The entire transmission lever is thus extraneous and immune to possible transverse movements induced to the cutting unit with respect to the support structure.

[0070] Signalling devices can also be provided for emitting a notification signal when the position of a diverging stretch of at least one continuous strip-like element exceeds a predetermined tolerance threshold.

[0071] In one embodiment, the following can be provided: sensor members for detecting the position of a diverging stretch of at least one continuous strip-like element; and a comparator for comparing the position detected by the sensor members with a preset theoretical reference position.

[0072] In a preferred embodiment, at least one actuator can be provided, acting on each first threaded element for automatically adjusting the orientation of the corresponding drift roller around the aforesaid correction axis following an output signal of an electronic control unit.

[0073] Said knives are preferably distributed in respective pairs, mutually spaced along a longitudinal translation direction of the continuous band.

[0074] The knives of each pair are symmetrically disposed relative to a longitudinal mid-line of the continuous band.

[0075] The knives are distributed so as to define a V-shaped configuration with vertex facing the collection unit. The knives are preferably carried by a carriage movable in a direction transverse to the feeding direction of the continuous band.

[0076] Preferably the knives are removably fixed on a support block removably fixed to the carriage.

[0077] Preferably the support block is positioned along a direction substantially parallel to the extension of a cutting edge of each knife.

[0078] The cutting unit can preferably comprise a centring guide operatively engaging the continuous band for maintaining a centred positioning of the latter relative to said knives.

[0079] Preferably the centring guide has a passage opening having width equal to the width of the continuous band. The centring guide is preferably fixed with respect to the cutting unit.

[0080] Thrust devices can also be provided for imposing transverse movements to the knives.

[0081] The thrust devices are preferably actuatable from outside said generation region.

[0082] The thrust devices can comprise an actuating arm acting on a carriage carrying said knives.

[0083] The thrust devices can comprise an actuating arm acting on the cutting unit.

[0084] Preferably, the actuating arm is removably engageable with the cutting unit.

[0085] In a preferred embodiment, the actuating arm is carried by a bar that is axially movable for imposing a transverse movement to the cutting unit.

[0086] The bar is preferably rotatable around a longitudinal axis thereof for disengaging the actuating arm from the cutting unit.

[0087] The band feeding devices can preferably comprise: devices for feeding elastomeric material to an extrusion die; devices for feeding, to the extrusion die, said reinforcing cords that are arranged parallel and adjacent to each other.

[0088] The collection unit comprises a plurality of reels, each dedicated to the winding of a respective continuous strip-like element.

[0089] Further characteristics and advantages will be clearer from the detailed but not exclusive description of a preferred embodiment of a process and a production line for controlled collection of continuous strip-like elements for building tyres, according with the present invention. Such description will be set forth hereinbelow with reference to the enclosed drawings, provided only as a non-limiting example, in which:

- figure 1 schematically shows, in plan view, a production line obtained in accordance with the present invention;
- figure 2 shows a detail of the production line in top view, highlighting a transition zone circumscribing the cutting unit;
- figure 3 shows a detail of figure 2 in side view;
- figure 4 shows the cutting unit in perspective view;
- figure 5 shows, in interrupted perspective view, a continuous strip-like element obtainable by means of the present invention.

[0090] With reference to the abovementioned figures, the reference number 1 was used to indicate a production line for controlled collection of continuous strip-like elements for building tyres, according to the present invention.

[0091] The production line 1 is provided to obtain and collect a plurality of continuous strip-like elements 2, of which one is represented in detail in figure 5, comprising a plurality of reinforcing cords 3, e.g. made of textile, synthetic and/or metallic material. The reinforcing cords 3 are extended parallel to each other, along a longitudinal extension direction of the continuous strip-like element 2, preferably in mutual-coplanarity relationship.

[0092] The reinforcing cords 3 are incorporated in or covered by at least one layer of raw elastomeric material 4. Each continuous strip-like element 2 is adapted to be used for the purpose of building tyres for vehicle wheels. For example, each continuous strip-like element 2 can for such purpose be cut into pieces of predetermined

length, to be used for obtaining carcass plies, belt layers or other components of a tyre being manufactured.

[0093] The production line 1 comprises band feeding devices 5 that supply a continuous band 6 of elastomeric material, comprising said reinforcing cords 3, preferably but not necessarily in a quantity equal to a multiple of a predetermined number of cords present in each of the continuous strip-like elements 2 during manufacturing. The band feeding devices 5 comprise cord feeding devices 7 which feed the reinforcing cords 3. The cord feeding devices 7 can for example comprise at least one creel 8 which sustains a plurality of packages 8a; from each of the latter, one of the reinforcing cords 3 is drawn to be used for the purpose of forming the continuous strip-like elements 2.

[0094] The reinforcing cords 3 coming from the creel 8 are conducted along paths mutually converging towards an extruder 9 fed with raw elastomeric material. It is preferably provided that the reinforcing cords 3 traverse at least one guide element, for example a comb element, in proximity to an extrusion die 10 in which the elastomeric material flows. The elastomeric material is preferably fed to the extrusion die 10 by means of feed devices comprising, for example, a extruder and/or a gear pump 11. The elastomeric material can reach the gear pump 11 upon action of a worm screw operatively housed in the extruder 9, upstream of the gear pump itself.

[0095] Inside the extrusion die 10, the raw elastomeric material is applied onto the reinforcing cords 3 longitudinally translating through the die itself. The reinforcing cords 3 exit from the extrusion die 10 along mutually parallel and coplanar trajectories; the cords 3 are covered with the layer 4 formed by the raw elastomeric material with which they have come into contact, to form the aforesaid continuous band 6.

[0096] The continuous band 6 can be subjected to the action of a tensioning unit 12, which drives the reinforcing cords 3 and the elastomeric material through the extrusion die 10 as a result of a traction action applied to the continuous band itself.

[0097] At the tensioning unit 12 or in a zone upstream and/or downstream thereof, a cooling action can also be carried out for the continuous band 6 exiting from the extrusion die 10. The cooling action allows carrying out a suitable structural consolidation of the raw elastomeric material and of the continuous band 6 in its entirety. Downstream of the tensioning unit 12, a storage unit 13 can be provided that defines a winding circuit capable of storing a section of suitable length of the continuous band 6 coming from the tensioning unit 12.

[0098] In a *per se* known manner and hence not further described herein, the winding circuit defined in the storage unit 13 has a length that can be modulated in response to possible variations of productivity of the continuous band 6 by the band feeding devices 5, and/or to varied requirements of continuous band 6 downstream of the same storage unit 13. Thus, a process continuity

is facilitated even in the presence of variations or temporary interruptions of productivity in portions of the production line 1 respectively downstream and upstream of the same storage unit 13.

[0099] Preferably the continuous band 6 is fed at a speed included between about 1 m/s and about 3 m/s.

[0100] Still more preferably said continuous band 6 is fed at a speed included between about 1.5 m/s and about 2.5 m/s.

[0101] A "region of generation" "Z" of continuous strip-like elements 2 comprises a cutting unit 14, and guiding devices 28.

[0102] Preferably said generation region "Z" is obtained in a space with prismatic conformation.

[0103] Preferably said generation region "Z" comprises at least a part of adjustment devices 30.

[0104] Said generation region "Z" nevertheless does not include drive devices 33, and possibly at least one portion of a support structure 23 engaging the drive devices themselves.

[0105] Cutting unit 14, guiding devices 28, adjustment devices 30, drive devices 33 and support structure 23 are more precisely described hereinbelow.

[0106] Preferably downstream of the storage unit 13, said cutting unit 14 slidably engages the continuous band 6 in order to divide it into a plurality of continuous strip-like elements 2, each comprising a predetermined number of reinforcing cords 3.

[0107] A drive unit 15 situated downstream of the cutting unit 14 operates on each of the continuous strip-like elements 2 for assuring the successive movement thereof to the cutting unit 14 itself.

[0108] Downstream of the drive unit 15, the continuous strip-like elements 2 are collected separately from each other by means of at least one collection unit 16, which in a preferred solution comprises a plurality of reels 17 each dedicated to the winding of a respective continuous strip-like element 2.

[0109] The cutting unit 14 comprises n knives 18 carried by a carriage 19 and operating through the continuous band 6 for generating n+1 continuous strip-like elements 2 therefrom.

[0110] The knives 18 are preferably distributed on one or more pairs, mutually spaced along a longitudinal translation direction "F" of the continuous band 6, preferably defining a V-shaped configuration with vertex facing the collection unit 16.

[0111] Preferably the knives 18 of each pair are symmetrically disposed relative to a longitudinal mid-line "L" of the continuous band 6.

[0112] In a preferred embodiment, a central knife 18 can be disposed at a vertex of the V-shaped configuration, in order to operate along the longitudinal mid-line "L" of the continuous band 6.

[0113] It is thus conveniently possible to carry out the cutting action simultaneously along the respectively opposite edges of the continuous band 6, in order to form pairs of continuous strip-like elements 2. Conveniently,

the pairs of continuous strip-like elements 2 are generated in succession starting from outer side edges of the continuous band 6 itself.

[0114] In a different preferred embodiment (not shown), at the vertex of the V-shaped configuration, a pair of knives 18 is provided. In such embodiment solution, the continuous strip-like element 2 that comes to be generated in central position continues straight and the cutting unit 14 gives rise - with its own action - to an odd number of continuous strip-like elements 2, in a number equal to $2n + 1$ where n is the number of pairs of knives 18 employed.

[0115] Preferably, the knives 18 are individually and removably fixed to respective abutment seats 20 provided on the carriage 19, each by means of a respective knife locking member 20a. The abutment seats 20 can be conveniently obtained on a support block 21 removably fixed to the carriage 19 by means of a block locking member 22, and positionable along a direction substantially parallel to the extension of a cutting edge 18a of each knife 18. By adjusting the position of the support block 21, it is therefore possible to simultaneously move all the knives 18, along the respective cutting edges 18a, and arrange them in different positions relative to a lying plane "P" of the continuous band 6, so that different portions of the cutting edge 18a of each knife 18 are successively placed in interference relationship with the advancement of the continuous band itself. In other words, it is possible to modify the position of the knives 18 in order to subject the continuous band 6 to the action of a new portion of the cutting edge 18a of each knife 18, for example when the previously used portion is worn. Each knife 18 is also adapted to be mounted according to at least two different positions, mutually rotated 180° , in order to offer a new, previously inactive portion of the cutting edge 18a to the continuous band 6.

[0116] Preferably, the cutting unit 14 is freely movable in a direction transverse to the longitudinal translation direction "F" of the continuous band 6. For such purpose, the carriage 19 can be provided slidably mounted on a fixed support structure 23. For example, the support structure 23 can have guide bars 24 that are transverse relative to a longitudinal extension direction of the continuous band 6, slidably traversing guide bushings 25 carried by the carriage 19.

[0117] The cutting unit 14 slidably engages the continuous band 6 at a centring guide 26.

[0118] More particularly the centring guide 26, preferably carried by the carriage 19, engages the continuous band 6 at a passage opening 27 having width equal to the width of the continuous band 6 itself. The continuous band 6 can thus maintain a centred positioning with respect to the knives 18. Possible lateral movements of the continuous band 6 coming from the band feeding devices 5 are indeed easily followed by corresponding lateral translations induced to the carriage 19. The engagement of the continuous band 6 through the centring guide 26 in fact transmits transverse thrust forces to the cutting

unit 14, due to the same transverse movements of the continuous band 6.

[0119] Said guiding devices 28 are housed inside said generation region "Z" containing the cutting unit 14. Devices 28 operate on the continuous strip-like elements 2 to impart respective drift forces thereto, so as to guide them along mutually diverging trajectories moving away from the respective knives 18.

[0120] More particularly, the guiding devices 28 comprise drift rollers 29, each of which adapted to operate in contact relationship with one of the continuous strip-like elements 2, preferably by means of an operative surface 29a with convex profile.

[0121] Preferably, for each continuous strip-like element 2 produced by the cutting unit 14, at least two drift rollers 29 are provided which are mutually aligned along a trajectory diverging from the longitudinal mid-line "L" of the continuous band 6.

[0122] Preferably, the drift rollers 29 are supported rotatably idle, each along a respective rotation axis "X" slightly inclined to a direction perpendicular to the longitudinal extension of a stretch of the continuous strip-like element 2 upstream of the drift roller 29 itself. The passage of the continuous strip-like elements 2 against the drift rollers 29 thus causes the generation of the desired drift thrusts, adapted to impose diverging trajectories to the continuous strip-like elements 2 translating away from the knives 18; such trajectories diverging with respect to each other and/or with respect to the continuous band 6.

[0123] More particularly, the drift rollers 29 can be conveniently positioned in a manner so as to impose, to each continuous strip-like element 2, at least one first deviation from the lying plane "P" of the continuous band 6, subsequent to the cutting action of the respective knives 18, and a second deviation opposite the first, i.e. directed laterally relative to the longitudinal extension direction of the continuous band 6. The first and the second deviations can also be carried out simultaneously, as components of a single oblique deviation.

[0124] Before reaching the drive unit 15, at least a part of the continuous strip-like elements 2 is also subjected to a third deviation towards the lying plane "P" of the continuous band 6. The continuous strip-like elements 2 are conveniently disposed coplanar to each other upon reaching the drive unit 15.

[0125] The size of the drift forces can be modulated by means of adjustment devices 30 associated with the guiding devices 28. It is thus possible to confer a correct and stable trajectory to the single continuous strip-like elements 2 generated by the cutting action.

[0126] The drift forces can also be modulated, if necessary, in response to possible transverse movements carried out by the continuous band 6. These lateral movements are induced to the continuous band 6 by various factors that are hard to predict or control, which for example are displayed at the band feeding devices 5 or other zones upstream of the cutting unit 14; such lateral

movements are in fact followed by the lateral mobility of the carriage 19, but cause relative movements between the knives 18 and the single drift rollers 29, with consequent modification of the trajectories and drift thrusts induced on the continuous strip-like elements 2. The modulability of the drift forces allows compensating for these variations and restoring the dynamic equilibrium conditions of the continuous strip-like elements 2 translating on the respective drift rollers 29.

[0127] For such purpose, each drift roller 29 can be conveniently supported by a rod 31 rotatably engaged through a base plate 32 carried by the support structure 23 of the cutting unit 14. More particularly, each rod 31 is rotatable around a correction axis "Y", perpendicular to the rotation axis "X" of the roller itself, upon actuation of drive members 33 situated externally of the aforesaid region of generation "Z" of continuous strip-like elements 2.

[0128] The drive members 33 comprise, for each drift roller 29, at least one first threaded element 34, e.g. a ring nut, rotatably engaged with the support structure 23 of the cutting unit 14, externally with respect to the aforesaid generation region "Z" containing the cutting unit 14.

[0129] The first threaded element 34, axially fixed with respect to the support structure 23, operates on a transmission lever 35 associated with the respective rod 31. The transmission lever 35 for example comprises a drive arm 36 operatively constrained, e.g. by a ball joint 37, to a lever 38 engaged with one end of the respective rod 31 by means of a clamp 39, so as to project radially with respect to the aforesaid correction axis "Y".

[0130] The first threaded element 34 operatively engages a second threaded element 40, represented for example by a thread carried by the drive arm 36.

[0131] By driving the first threaded element 34 in rotation, it is thus possible to orient the positioning of the respective drift roller 29 around the correction axis "Y", so as to actuate a fine adjustment of the drift forces induced by the same drift roller 29 on the continuous strip-like element 2.

[0132] The modulation action of the drift forces can be manually executed, following a visual control at fairly frequent intervals of the stability of the trajectories carried out by the continuous strip-like elements 2 translating away from the knives 18. An operator can in fact manually operate on the first threaded elements 34 for correcting the trajectory imposed on one or more of the continuous strip-like elements 2, upon detection of possible irregularities in the trajectories themselves. In order to facilitate a timely operation by the operator, the use of signalling devices 41 may be provided for emitting a notification signal, e.g. acoustic and/or visual, when the position of a diverging stretch of at least one continuous strip-like element 2 exceeds a predetermined tolerance threshold.

[0133] Such signalling devices 41 can for example comprise sensor members 42 e.g. of optical, mechanical or other type, which detect the position of the diverging stretch of each of the continuous strip-like elements 2, in

the generation region "Z".

[0134] In an electronic control unit 43, preferably programmable, a theoretical reference position is stored of the diverging stretch of each of the continuous strip-like elements 2. A comparator 44 associated with the electronic control unit 43 compares the position detected by the sensor members 42 with the preset theoretical reference position.

[0135] When the difference between the position of the diverging stretch and the theoretical reference position exceeds a predetermined tolerance threshold, the emission of the notification signal is enabled by the signalling devices 41.

[0136] In a preferred embodiment, at least one actuator (not shown) acts on each first threaded element 34 by automatically adjusting the orientation of the corresponding drift roller 39 around the aforesaid correction axis "Y" following an output signal of said electronic control unit 43.

[0137] The cutting action of each knife 18 is exerted between two contiguous reinforcing cords 3 of the continuous band 6, in a manner such that each continuous strip-like element 2 has a predetermined number of reinforcing cords 3.

[0138] Nevertheless, it may occur that due to uncontrolled movements of the continuous band 6 with respect to the knives 18 during manufacturing at high speed, one or more of the knives 18 cuts one of the adjacent reinforcing cords 3 and the system has a new equilibrium condition in which not all of the continuous strip-like elements 2 are formed in accordance with the correct width and/or with the predetermined number of reinforcing cords 3.

[0139] In order to remedy the above situation, the cutting unit 14 can also be associated with thrust devices 45 which, if necessary, are adapted to correcting the relative positioning between the continuous band 6 and the knives 18 during translation of the continuous strip-like elements 2, by imposing transverse movements to cutting unit 14. More particularly, the thrust devices 45 are adapted to be driven from outside the generation region "Z", in order to impose transverse movements to the knives 18 with respect to the drift rollers 29. Preferably, the thrust devices 45 comprise an actuating arm 46 carried by a bar 47, preferably with circular section, that is axially and rotatably movable through the support structure 23 of the carriage 19. A control knob 48 carried by the bar 47 allows moving the actuating arm 46 between a rest condition in which it is disengaged from the carriage 19 and an operative condition in which it engages the carriage 19. For such purpose, the actuating arm 46 can be provided for example with a fork-like end 49 in which a grip tab 50 carried by the centring guide 26 is removably insertable.

[0140] In normal functioning conditions of the production line 1, the actuating arm 46 is maintained in rest condition, disengaged from the carriage 19. When a correction operation is required, an operator can intervene

on the control knob 48 in order to bring the actuating arm 46 in engagement relationship with the carriage 19, and transmit small strikes or thrust actions to the carriage itself, so as to impose sudden transverse movements to the knives 18.

[0141] These transverse movements cause a movement of the continuous band 6 with respect to the knives 18, due to the reactions induced by the continuous strip-like elements 2 translating in engagement relationship on the drift rollers 29, so as to restore the correct position of the latter with respect to the knives 18.

Claims

1. A process for controlled collection of continuous strip-like elements (2) for building tyres, comprising:

feeding a continuous band (6) of elastomeric material comprising reinforcing cords (3);
in a region of generation (Z) of continuous strip-like elements (2), cutting said continuous band (6) generating continuous strip-like elements (2);
in said generation region (Z) of continuous strip-like elements (2), applying drift forces to each of said continuous strip-like elements (2) to guide them along diverging trajectories;
modulating said drift forces by drive members (33) placed externally of said generation region (Z) of continuous strip-like elements (2);

collecting each continuous strip-like element (2).

2. A process as claimed in one or more of the preceding claims, wherein in said generation region (Z), at least one first deviation from the lying plane ("P") of the continuous band (6), a second deviation directed laterally relative to the longitudinal extension direction of the continuous band (6), and at least one third deviation towards a lying plane (P) of the continuous band (6) are imposed to the continuous strip-like elements (2), wherein said continuous strip-like elements (2), following the third deviation, are brought into mutual-coplanarity relationship.
3. A process as claimed in one or more of the preceding claims, wherein said drift forces are generated by passage of the continuous strip-like elements (2) against drift rollers (29).
4. A process as claimed in claim 3, wherein the action of modulating the drift forces is carried out by rotating at least one of said drift rollers (29) around a correction axis (Y) perpendicular to a rotation axis (X) thereof.
5. A process as claimed in one or more of the preceding

claims, wherein the cutting action is carried out simultaneously along the respectively opposite edges of the continuous band (6) for generating pairs of continuous strip-like elements (2), wherein said pairs of continuous strip-like elements (2) are generated in succession starting from outer side edges of the continuous band (6).

6. A process as claimed in one or more of the preceding claims, further comprising the action of laterally translating a carriage (19) carrying knives (18) for following transverse movements of the continuous band (6).

7. A process as claimed in claim 6, further comprising the action of correcting the relative positioning between the continuous band (6) and the knives (18) during translation of the continuous strip-like elements (2).

8. A process as claimed in claim 7, wherein said corrections are carried out by imposing transverse movements to said knives (18) relative to drift rollers (29) against which the continuous strip-like elements (2) pass.

9. A process as claimed in claim 8, wherein said transverse movements are carried out by an actuating arm (46) that is disengaged from the cutting unit (14) when correction has occurred.

10. A production line for controlled collection of continuous strip-like elements (2) for building tyres, comprising:

band feeding devices (5) for feeding a continuous band (6) of elastomeric material comprising reinforcing cords (3);

a cutting unit (14) slidably engaging said continuous band (6) and carrying knives (18) operating through the continuous band (6) for generating continuous strip-like elements (2) therefrom;

guiding devices (28) operating on said continuous strip-like elements (2) to impart respective drift forces, guiding them along mutually diverging trajectories;

adjustment devices (30) for modulating said drift forces on said continuous strip-like elements (2);

at least one collection unit for collecting each continuous strip-like element (2);

wherein said adjustment devices (30) can be operated by drive members (33) disposed externally of a generation region (Z) of said continuous strip-like elements (2).

11. A production line as claimed in claim 10, wherein the guiding devices (28) comprise drift rollers (29) provided for operating in contact relationship with said

continuous strip-like elements (2), wherein each drift roller (29) is positionable around a correction axis (Y) perpendicular to a rotation axis (X) thereof.

12. A production line as claimed in one or more of claims 10 to 11, wherein the knives (18) are distributed so as to define a V-shaped configuration with vertex facing the collection unit (16).

13. A production line as claimed in one or more of claims 10 to 12, wherein the knives (18) are carried by a carriage (19) movable in a direction transverse to the feeding direction of the continuous band (6).

14. A production line as claimed in one or more of claims 10 to 13, further comprising thrust devices (45) for imposing transverse movements to the knives (18) wherein the thrust devices (45) comprise an actuating arm (46) acting on a carriage (19) carrying said knives.

15. A production line as claimed in claim 14, wherein the actuating arm (46) is carried by a bar (47) that is axially movable for imposing a transverse movement to the cutting unit (14).

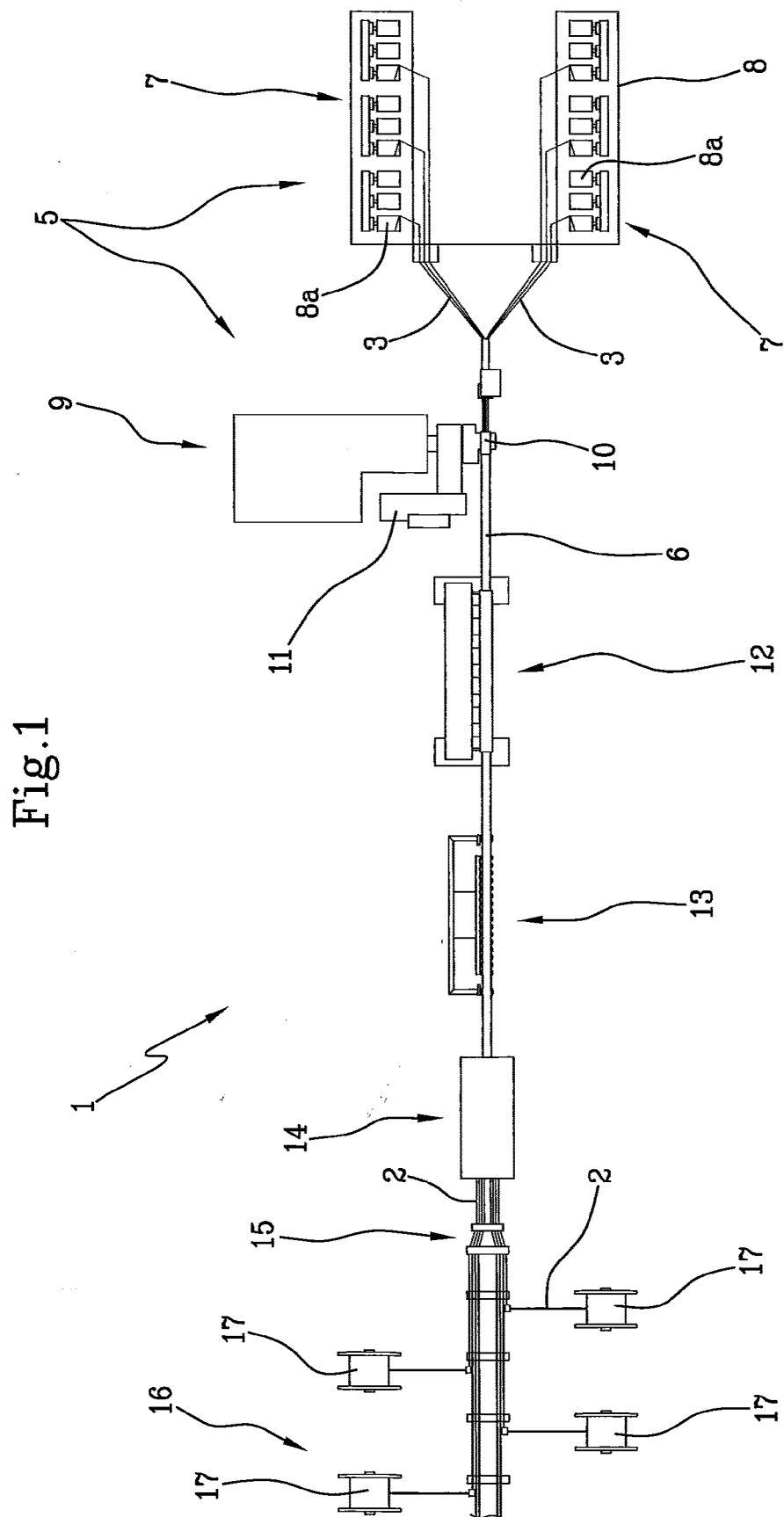


Fig.2

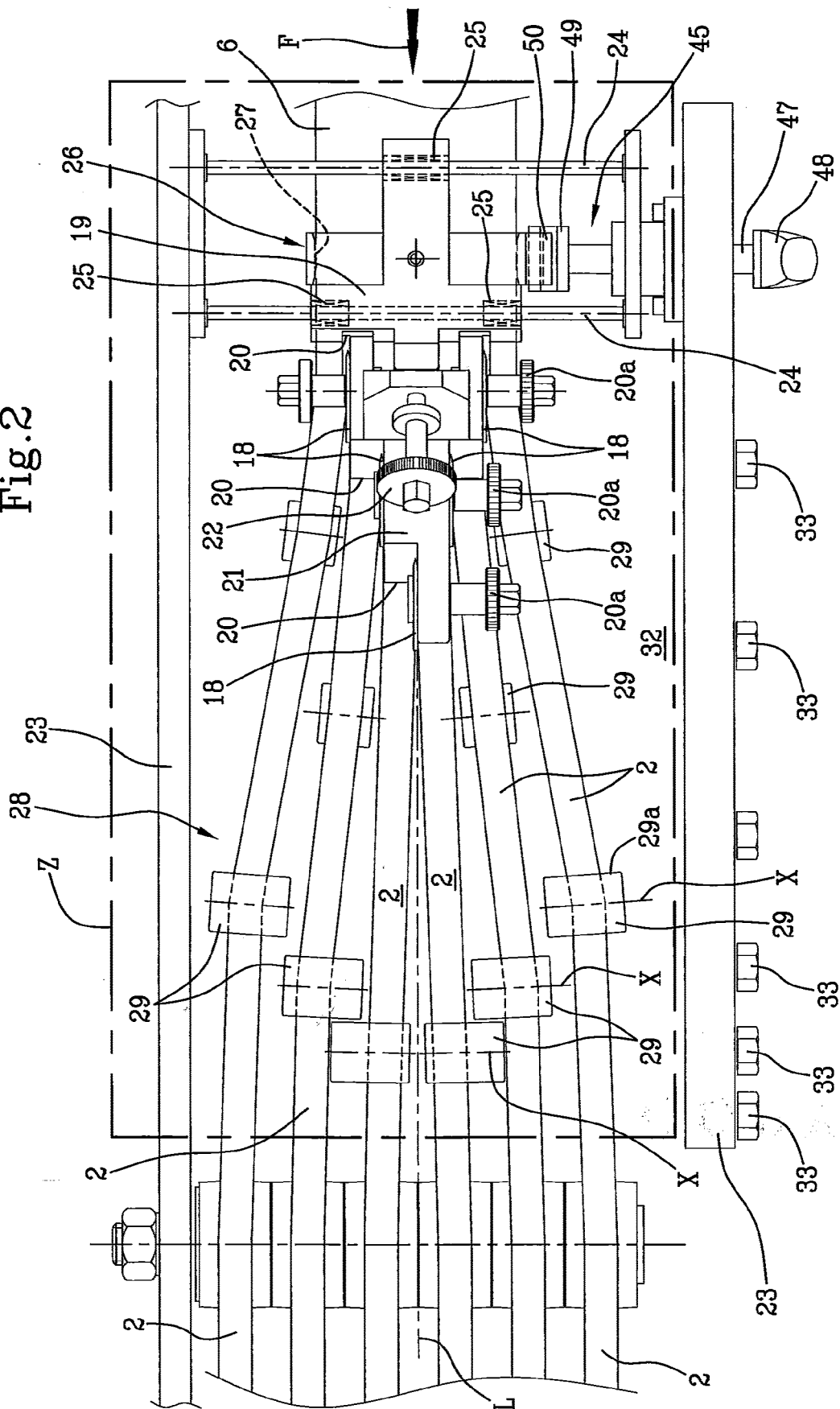


Fig.3

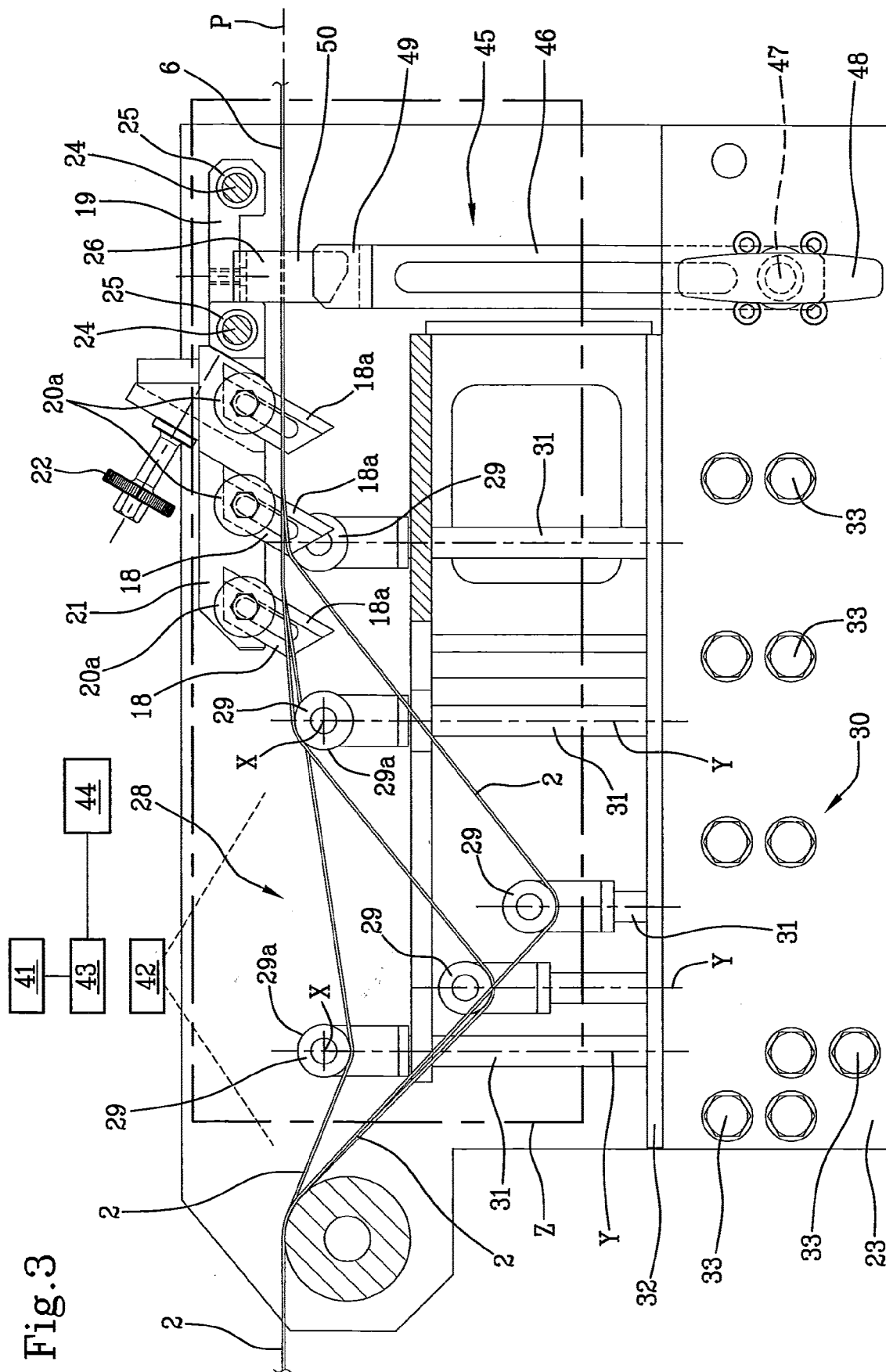


Fig.4

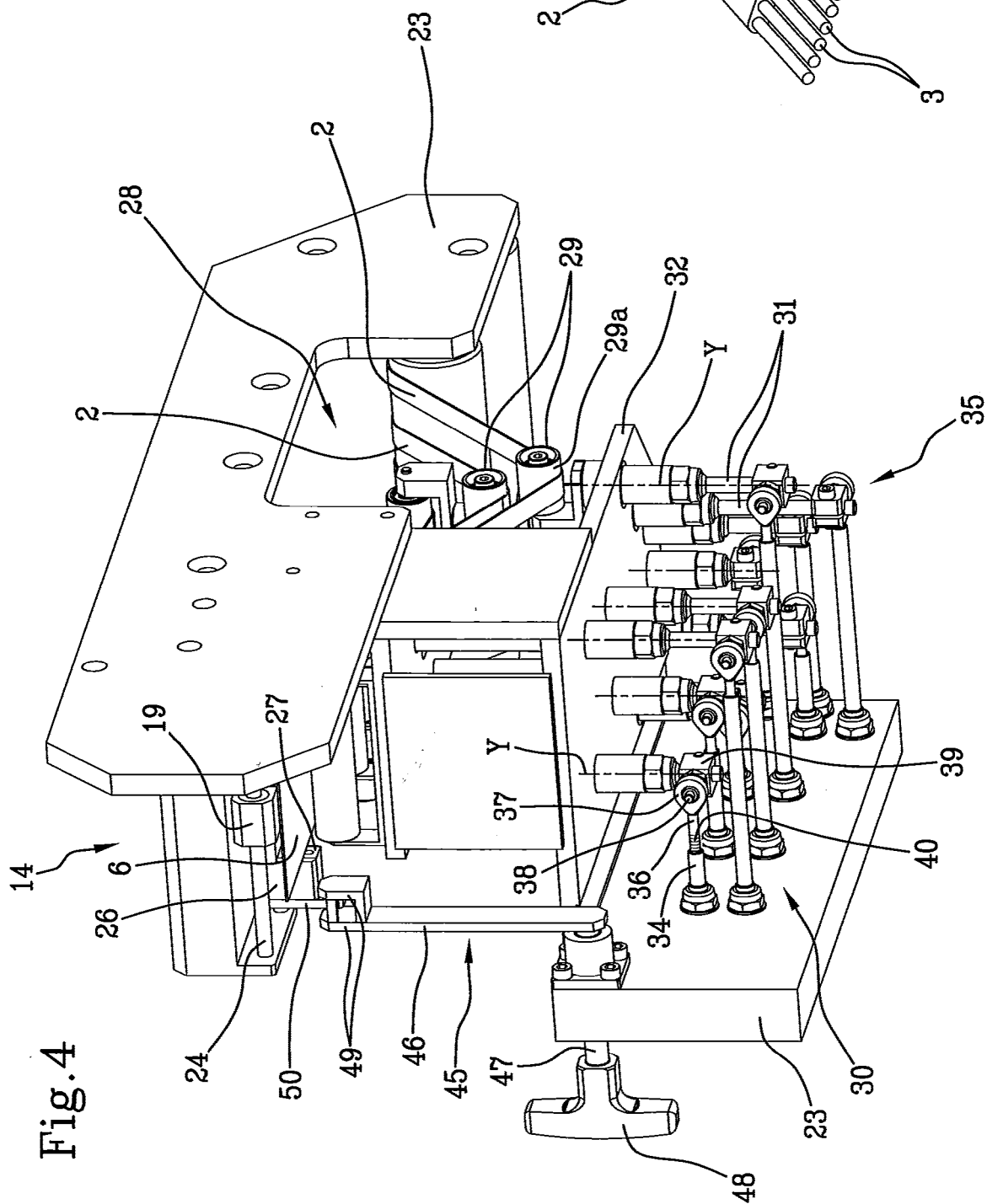
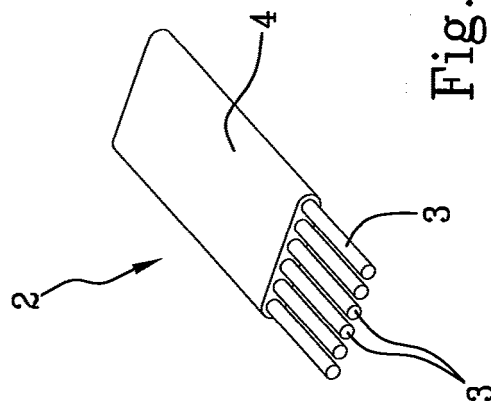


Fig.5





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