(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2015 (23.12.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/194941 A1

(51) International Patent Classification:
B29D 30/44 (2006.01)

(21) International Application Number:
PCT/NL2015/050400

(22) International Filing Date:
3 June 2015 (03.06.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2013038 19 June 2014 (19.06.2014) NL

(71) Applicant: **VMI HOLLAND B.V.** [NL/NL]; Gelriaweg 16, NL-8161 RK Epe (NL).

(72) Inventors: **HERKLOTS, Jurgen Gregorius**; Leoninusstraat 16, NL-6821 ER Arnhem (NL). **WACHTER, Simon Benedikt**; Marienbader Strasse 2, 93057 Regensburg (DE).

(74) Agent: **MELCHIOR, Robin**; Octrooibureau Vriesendorp & Gaade B.V., Koninginnegracht 19, 2514 AB Den Haag (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: TIRE BUILDING MACHINE COMPRISING A DEVICE FOR CENTERING A TIRE COMPONENT

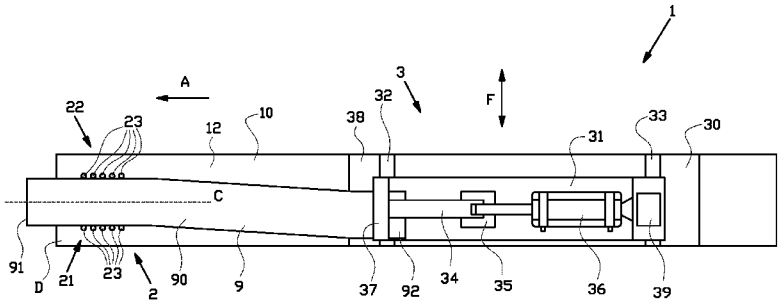


FIG. 2

(57) Abstract: The invention relates to a tire building machine (1) for centering a tire component, comprising a supply conveyor (10) for transporting a tire component (9) in a supply direction (A), a centering device (2) for centering the tire component with respect to a center line (C) parallel to the supply direction as the tire component is being transported in the supply direction and a clamping device (3) for clamping the tire component during at least a part of the centering, wherein the supply conveyor (10) is provided with a transport surface (12) which is arranged for supporting the tire component during the transport, wherein the clamping device (3) comprises a clamping member (37) for clamping a part of the tire component, wherein the clamping member (37) is arranged to move together with the transport surface (12) in the supply direction, wherein the clamping member (37) is further arranged to be movable in a floating direction transverse to the supply direction.

WO 2015/194941 A1

TIRE BUILDING MACHINE COMPRISING A DEVICE FOR CENTERING A TIRE COMPONENT

BACKGROUND

The invention relates to a tire building machine for centering a tire component.

Known tire building machines comprise a centering station for centering a tire component and a supply conveyor for receiving the centered tire component and for subsequently supplying the centered tire component to a subsequent stage of the tire manufacturing process. During transfer from the centering station to the supply conveyor, the centered tire component may shift or deform, thereby at least partly cancelling the carefully performed centering at the centering station. In addition, the centering at the centering station and subsequent transfer to the supply conveyor is time consuming and reduces the operational efficiency of the supply conveyor and the subsequent stage of the tire manufacturing process.

US 4,049,486 A discloses a strip guiding apparatus that is placed in a fixed position at the downstream end of a roller conveyor in the direction of conveyance. The strip guiding apparatus comprises lower guide rollers which are canted to actively push a tread strip into a centered position. Misalignments in the tread strip are thus actively corrected near the downstream end of the roller conveyor. The strip guiding apparatus is further provided with upper pressure rollers which are transversely movable over respective mounting axles with respect to the direction of conveyance, and which are actively biased to a center

position by two springs.

It is an object of the present invention to provide a tire building machine for centering a tire component, wherein the centering of the tire component can be improved.

SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a tire building machine for centering a tire component, comprising a supply conveyor for transporting a tire component in a supply direction, a centering device for centering the tire component with respect to a center line parallel to the supply direction as the tire component is being transported in the supply direction and a clamping device for clamping the tire component during at least a part of the centering, wherein the supply conveyor is provided with a transport surface which is arranged for moving in the supply direction and for supporting the tire component during the transport in said supply direction, wherein the clamping device comprises a clamping member for clamping a part of the tire component, wherein the clamping member is arranged to move together with the transport surface in the supply direction, wherein the clamping member is further arranged for freely following the part of the tire component to which it is clamped in a floating direction that is substantially parallel to the transport surface and transverse to the supply direction.

The clamping member can thus allow the clamped part of the tire component to freely follow the rest of the tire component in the floating direction. As the tire component is centered on the transport surface of the supply conveyor, during the transport of the tire component in the supply direction, the cycle time of the combined supply and centering of the tire component can be significantly reduced. Furthermore, due to the absence of a separate

centering station adjacent to the supply conveyor, access to the supply conveyor can be improved. The freely moving clamping member can function without biasing means or an active drive, which can significantly reduce the complexity of the tire building machine.

In an embodiment the floating direction is perpendicular or substantially perpendicular to the supply direction. This can prevent that the clamping member is biased to move in one direction only. Forces exerted on the clamping member by the tire component can thus be converted into a corresponding movement of the clamping member in the floating direction depending on the deviation of the direction of those forces with respect to the supply direction.

In a preferred embodiment the clamping member is arranged to be movable in translation in the floating direction. The translation can be easily guided and/or controlled.

In an embodiment the clamping member is arranged for passively following the part of the tire component to which it is clamped in the floating direction. The tire component can thus be aligned with the help of the clamping member without active control of the movement of the clamping member in the floating direction. The absence of active controls can reduce the complexity of the tire building machine.

In an embodiment the tire component is provided with a leading end facing in the supply direction and a trailing end facing in a direction opposite to the supply direction, wherein the centering device is arranged for progressively centering the tire component from its leading end towards its trailing end, wherein the clamping member is arranged to clamp the trailing end. Thus, as the leading end and the body of the tire component between the leading end and the trailing end is progressively centered, the trailing end can be retained by the clamping device and can be allowed to follow the progressive centering of the rest of

the tire component. Depending on the stiffness of the tire component, the progressive centering of the leading end and the body of the tire component causes a buildup of tension or force in the tire component in a direction transverse to the supply direction, which tension or force can be converted by the clamping device into the movement of the clamping member in the floating direction.

In an embodiment the tire building machine is provided with a retaining element for retaining the leading end of the tire component while the trailing end is clamped by the clamping device. By retaining the leading end of the tire component and clamping the trailing end of the tire component, the length of the tire component can be controlled.

In an embodiment the clamping device comprises a floating base member for supporting the clamping member and a fixed base member for supporting the floating base member, wherein the fixed base member is arranged to be moved together with the transport surface in the supply direction and wherein the floating base member is arranged to be movable in the floating direction with respect to the fixed base member. The floating base member can thus provide the required freedom of movement of the base member in the floating direction, while the fixed base member can be operationally coupled to the speed of the tire component in the supply direction.

In an unclaimed embodiment the clamping device is provided with a floating drive for driving the movement of the floating base member with respect to the fixed base member in the floating direction. The floating drive can actively control the movement of the floating base member to control and/or improve the centering of the tire component.

In an embodiment the transport surface is arranged to be movable in the supply direction, wherein the fixed base member is arranged to be coupled to the transport surface so as to be movable in unison with the transport surface in the supply direction. The movement of the

clamping member in the supply direction can thus be actuated by the transport surface. A separate clamp drive for individually driving the clamping member in the supply direction is not required.

In a preferred embodiment thereof the supply conveyor comprises an endless belt, wherein the transport surface is formed by the upper run of the endless belt.

In an embodiment the fixed base member is arranged to be coupled to the transport surface by fasteners. In an alternative embodiment the fixed base member is arranged to be coupled to the transport surface by friction or adhesion. In both these embodiments, the clamping device can be securely placed onto a supply conveyor. The supply conveyor may be an existing supply conveyor which is retrofitted with the clamping device according to the invention.

In an embodiment the supply conveyor is provided with a conveyor drive for driving the supply conveyor in the supply direction, wherein the tire building machine is further provided with a clamp drive for driving the movement of the fixed base member in the supply direction, wherein the clamp drive is operationally coupled to the conveyor drive for synchronizing the speed of the driven movement of the fixed base member with the speed of the supply conveyor in the supply direction. This embodiment, although slightly more complex than the previous embodiments, can provide the same effect of having the clamp member move at the same (synchronized) speed as the tire component in the supply direction.

According to a second aspect the invention provides the aforementioned clamping device, for use in the aforementioned tire building machine. This clamping device can be placed in the aforementioned tire building machine. The clamping device may be used to retrofit an existing tire building machine, which, when fitted with the centering device according to the invention, eliminates the need for a separate centering station.

According to a third aspect the invention provides a method for centering a tire component, wherein the method comprises the steps of:

- transporting the tire component on a transport surface of a supply conveyor in a supply direction;
- centering the tire component with a centering device with respect to a center line parallel to the supply direction as the tire component is being transported in the supply direction; and
- clamping the tire component with a clamping device during at least a part of the centering;

wherein the clamping device comprises a clamping member for clamping a part of the tire component, wherein the clamping member is arranged to move together with the transport surface in the supply direction, wherein the clamping member further freely follows the part of the tire component to which it is clamped in a floating direction that is substantially parallel to the transport surface and transverse to the supply direction.

Again, the clamping member can allow the clamped part of the tire component to freely follow the rest of the tire component in the floating direction. As the tire component is centered on the transport surface of the supply conveyor, during the transport of the tire component in the supply direction, the cycle time of the combined supply and centering of the tire component can be significantly reduced. Furthermore, due to the absence of a separate centering station adjacent to the supply conveyor, access to the supply conveyor can be improved.

In an embodiment of the method, prior to the step of transporting the tire component on the transport surface of the supply conveyor in the supply direction, the method comprises the steps of:

- positioning the clamping device into a starting position at a distance from the centering device in the supply direction, which distance is dependent on the length of the tire component in the supply direction;

- receiving the tire component on the transport surface between the centering device and the clamping device. The starting position can be chosen, within the length of the supply conveyor, at a variable distance from the centering device, to accommodate various lengths of tire components.

The various aspects and features described and shown in the specification can be applied, individually, wherever possible. These individual aspects, in particular the aspects and features described in the attached dependent claims, can be made subject of divisional patent applications.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be elucidated on the basis of an exemplary embodiment shown in the attached schematic drawings, in which:

figure 1 shows a side view of a tire building machine with a clamping device according to a first embodiment of the invention;

figure 2 shows a top view of the tire building machine according to figure 1, with the clamping device in a start position;

figure 3 shows the tire building machine according to figure 1, with the clamping device in an end position;

figure 4 shows top view of an alternative tire building machine according to a second embodiment of the invention;

figure 5 shows the tire building machine according to figures 1-3 in a first application with a tire building drum for supporting a buffed tire;

figure 6 shows the tire building machine according to figures 1-3 in a second application with a discharge conveyor; and

figure 7 shows a further alternative tire building

machine according to a third embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1,2 and 3 show a tire building machine 1 with a centering device 2 and a clamping device 3 according to an exemplary embodiment of the invention. The tire building machine 1 is arranged for centering a tire component 9 with respect to a subsequent stage of a tire manufacturing process while retaining and/or controlling the length of the tire component 9 during the centering. The control of the length L of the tire component 9 is particularly useful to improve the quality of the splice matching of the tire component 9

The tire building machine 1 comprises a supply conveyor 10 for supplying and transporting the tire component 9 in a supply direction A. The supply conveyor 10 is provided with an endless belt 11 having an upper run or transport run, or transport surface 12 and a lower run or return run 13. The transport surface 12 has a length that is sufficient to support the entire length of the tire component 9. The transport surface 12 of the endless belt 11 is driven by a conveyor drive (not shown) to move in a supply direction A towards a discharge end D. The conveyor drive is particularly arranged to drive the transport surface 12 over a stroke between a start position and an end position that is sufficient to apply or transfer the entire length of the tire component 9 in the next stage of the tire manufacturing process.

As shown in figure 2, the centering device 2 is provided with a first guide 21 and a second guide 22 at or near the discharge end D of the transport surface 12, which guides 21, 22 are arranged to extend on opposite sides alongside the tire component 9 for centering the tire component 9 with respect to a center line C. The first guide 21 and the second guide 22 are symmetrically spaced with

respect to the center line C at a distance that substantially corresponds to the width of the tire component 9. In this exemplary embodiment, the first guide 21 and the second guide 22 each comprise a plurality of vertically orientated, freely rotatable rollers 23. During centering of the tire component 9 by the centering device 2, the centering device 2 is in a fixed position with respect to the supply direction A, while the elongated body 90 of the tire component 9 is passed in between the guides 21, 22 in the supply direction A.

The tire component 9 is manually or mechanically placed on the transport surface 12 of the endless belt 11. The tire component 9 has a elongate body 90 with a leading end 91 facing in the supply direction A and a trailing end 92 facing in a direction opposite to the supply direction. An operator ensures that at least the leading end 91 of the tire component 9 is centered with respect to the center line C. The placement of the remainder of the tire component 9 is usually random and not very accurate. The trailing end 92 is typically shifted with respect to the center line C. As a result, the elongate body 90 of the tire component 9 may be under an oblique angle with respect to the supply direction A, or the body 90 may be deformed, bend and/or warped. The tire component 9 thus requires additional handling to adjust its position and/or centering.

For this purpose, the tire building machine 1 is provided with the clamping device 3 according to the invention. As shown in figures 1 and 2, the clamping device 3 comprises a fixed base member 30 that is operationally coupled to the transport surface 12 of the endless belt 11 so as to be movable at the same speed as, together with or in unison with the transport surface 12 of the endless belt 11 in the supply direction A. The coupling can either be a fixed mounting, e.g. with the use of fasteners, or a coupling through friction and/or adhesion. The clamping device 3 is provided with a floating base member 31 which is arranged to be easily, freely and/or passively movable or

translatable with respect to the fixed base member 30 in a floating direction F substantially parallel to the transport surface 12 and transverse or perpendicular to the supply direction A. Free or passive movement of the floating base member 31 with respect to the fixed base member 30 means that the floating base member 31 is not hindered, hampered or restricted by the fixed base member 30 in its movement in the floating direction F. In other words, apart from some minor friction force, there are no biasing forces or active driving force exerted by the fixed base member 30 onto the floating base member 31 in the floating direction F. In this exemplary embodiment, the floating base member 31 is coupled to the fixed base member 30 via a first rail set 32 and a second rail set 33, each extending in the floating direction F.

As best seen in figure 1, the clamping device 3 comprises a clamping member 34 for clamping the trailing end 92 of the tire component 9 in a clamping direction R and a hinge 35 for rotatably coupling the clamping member 34 to the floating base member 31. The clamping device 3 is further provided with an actuator 36, e.g. a pneumatic piston, for moving the clamping device 3 in rotation in the clamping direction R into clamping engagement with the trailing end 92 of the tire component 9. In this exemplary embodiment, the clamping member 34 takes the form of an L-shaped lever which, at one end, is coupled to the actuator 36 and, at the opposite end, is provided with a clamping bar 37 for securely clamping the trailing end 92 of the tire component 9, preferably along the entire width of the tire component 9. Due to the form of the L-shaped lever, the clamping bar 37 can be brought into vertical clamping engagement with the tire component 9.

The clamping device 3 further comprises an optional ramp 38 that provides an inclined transitional surface between the transport surface 12 and the surface of the floating base member 31 that is higher than said transport surface 12.

Optionally, in an unclaimed embodiment, a floating drive 39 is provided for actively driving and/or controlling the movement of the floating base member 31 with respect to the fixed base member 30 in the floating direction A.

A method for centering the tire component 9 with the use of the aforementioned tire building machine 1 will be described below, with reference to figures 2 and 3.

Figure 2 shows the situation in which the tire building machine 1 is at the beginning of centering process. The support surface 12 and the clamping device 3 operationally associated therewith have been returned to a starting position. In the starting position, the clamping device 3 is located at a distance from the centering device 2 that is equivalent to the length of the tire component 9 to be centered. The clamping device 3 is thus located at or near the expected position of the trailing end 92 of the tire component 9. Depending on the length of the supply conveyor 10, the starting position may be at the rear of the supply conveyor 10 or at an intermediate position. If the supply conveyor 10 has sufficient length, the tire building machine 1 can be used to center various lengths of the tire components 9. For each variation in length, the clamping device 3 is returned to a different starting position at a distance from the centering device 2 corresponding to said varied length.

With the clamping device 3 in a suitable starting position, the tire component 9 is manually or mechanically placed on the transport surface 12 of the supply conveyor 10, between the centering device 2 and the clamping device 3. The leading end 91 of the tire component 9 is aligned with or placed in between the guides 21, 22 of the centering device 2. The position of the trailing end 92 is inaccurate. For the illustrational purposes, the deformation in the elongate body 90 of the tire component 9 is exaggerated. In practise, the deformation may be smaller. Still, a shift in the position of the trailing end 92 with respect to the leading end 91 of just a few millimetres, if not corrected,

can already have a dramatic impact on the quality of the subsequent application or transfer of the tire components in the next stage of the tire manufacturing process.

As shown in figure 2, the trailing end 92 of the tire component 9 is at least partly deposited on the floating base member 31 of the clamping device 34 in the starting position. The inclined support surface 38 provides a relatively smooth transition of the tire component 9 from the transport surface 12 to the floating base member 31. The actuator 36 of the clamping device 34 has been actuated to rotate the clamping member 34 in the clamping direction R until its clamping bar 37 is in clamping engagement with the trailing end 92 of the tire component 9. The trailing end 92 of the tire component 9 is now securely clamped by the clamping device 3.

With the leading end 91 aligned with or placed in between the guides 21, 22, the conveyor drive is subsequently operated to move the transport surface 12 in the supply direction A towards the end position as shown in figure 3. During said movement, the tire component 9 and the clamping device 3, both supported on the transport surface 12, move together with the support surface 12 in the supply direction A. As the elongate body 90 of the tire component 9 passes in between the guides 21, 22 of the centering device 2, the body 90 is progressively centered and/or aligned with respect to the center line C from its leading end 91 towards its trailing end 92. When a part of the body 90 of the tire component 9 has been centered progressively, the stiffness in the material of the body 90 causes an increasing build-up of tension or transverse force in the remaining, uncentered body 90 of the tire component 9. The tension or force is transmitted onto the clamping device 3, which in turn converts said tension into a free movement of the clamping member 34 and the floating base member 31 in the floating direction F. Thus, the trailing end 92 of the tire component 9 is allowed to freely move and progressively and/or passively follow the leading end 91 of the tire component 9

into alignment with the center line C as a result of the tension or force being transmitted onto and converted into free movement of the clamping device 3. Ultimately, the clamping device 3 is centered together with the trailing end 92 with respect to the center line C.

Shortly prior to or in the end position as shown in figure 3, the actuator 36 is operated and the trailing end 92 of the tire component 9 is released from the clamping device 3. The uncentered trailing end 92 is relatively small with respect to the overall length of the tire component 9 and has already been positioned by the floating movement of the clamping device 3 into a near perfect alignment with the center line C at the centering device 2. Thus, the trailing end 92 can be centered easily without further assistance of the clamping device 3. Subsequently, the trailing end 92 of the tire component 9 is picked up, transferred or applied in the subsequent stage of the tire manufacturing process. The clamping device 3 can now be returned to its starting position as shown in figure 2, for a next cycle of the aforementioned method.

Figure 4 shows an alternative tire building machine 101 according to a second embodiment of the invention, in which an alternative clamping device 103 is provided with a fixed base member 130 is coupled to a separate clamp drive 110 adjacent to the supply conveyor 10. The separate clamp drive 110 is arranged for moving the fixed base member 130 parallel to the supply direction A. In this embodiment, where the fixed base member 130 is not directly coupled to the transport surface 12, the externally driven movement of the fixed base member 30 is electronically synchronized with the movement of the transport surface 12 in the supply direction A. Since the fixed base member 130 is not directly coupled to the transport surface 12, there is no requirement for the transport surface 12 to be able to fixedly receive said fixed base member 130. Thus conveyor 10 may be an alternative conveyor with a dynamic surface, e.g. a roller

conveyor. The alternative embodiment according to figure 4 has the same effect, yet seems to be less favorable due to its complexity.

Figure 5 shows the situation wherein the tire component 9 is a tire tread 9 and wherein the subsequent stage of the tire manufacturing process is the application of the centered tire tread 9 to a carcass or a buffed tire 70 on a tire building drum 7, the latter process also being known as 'retreading'. The current invention is particularly useful for retreading since this process requires an accurate control of the length of the tire tread 9, as well as accurate centering. In retreading, the tire tread 9 is dimensioned just a little shorter than the circumference of the carcass or the buffed tire 70. To get a closed or matched splice, the tread has to be stretched. Thus, the leading end 91 of the tire tread 9 is retained or clamped by a retaining element 71 to the buffed tire 70, while the trailing end 92 is retained by the clamping device 9. The conveyor drive is actively controlled with respect to the rotation of the tire building drum 7, to pull on the trailing end 92 and, as such, control or stretch the length of the tire tread 9. The clamping device 3 can thus provide a secure clamping of the trailing end 92 and simultaneously progressively align the tire tread 9 with the center line C. As the clamping device 3 does not move fully onto the discharge end D of the supply conveyor 10 and the guides 21, 22 are kept relatively small, the tire building drum 7 and/or the supply conveyor 10 can be brought into close mutual proximity for subsequent application of the tire tread 9 to the carcass or the buffed tire 70.

Figure 6 shows the situation wherein the subsequent stage of the tire manufacturing process involves transferring and/or discharging the centered tire component 9 to a downstream discharge conveyor 8. The discharge conveyor 8 is provided with a retaining element (not shown), e.g. magnets or suction, which is arranged to engage the tire component 9 at its leading end 91 while the trailing

end 92 is retained by the clamping device 3. After the tire component 9 is fully discharged from the supply conveyor 10, the discharge conveyor 8 is arranged for transporting the tire component 9 to a subsequent station (not shown) of the tire building machine 1.

It is to be understood that the above description is included to illustrate the operation of the preferred embodiments and is not meant to limit the scope of the invention. From the above discussion, many variations will be apparent to one skilled in the art that would yet be encompassed by the spirit and scope of the present invention.

For example, it is noted that the tire component 9 may be any tire component, e.g. a breaker or a sidewall, that requires centering and control of its length L during said centering, preferably for the purpose of splice matching. It will furthermore be apparent to one skilled in the art that the clamping functionality of the clamping device 2 can be achieved in many different ways, e.g. by pins, suction or magnets, which techniques are known per se. Also, the belt of the conveyor does not necessarily have to be an endless belt, particularly since the fixed base member inhibits a full revolution of said endless belt. An example of an alternative conveyor has already been mentioned above in relation to figure 4, where the conveyor could also be a roller conveyor. Alternatively, a belt with a suitable finite length may be used. Such finite length belt is paid out from a reel at one end and taken in onto a reel at the opposite end of the supply conveyor. In fact any conveyor with a transport run or transport surface that is movable in the supply direction A to apply or transfer the tire component 9 in the subsequent stage of the tire manufacturing process can be used for the purpose of the invention.

Figure 7 shows a further alternative of a tire building machine 201 according to a third embodiment of the invention, in which an alternative clamping device 203 is

provided with a fixed base member 230 that is integrated and/or recessed with respect to the transport surface 12 of the endless belt 11. Thus, an alternative floating base member 231 can be movably arranged on rail sets 32, 33 while its upper surface is flush or substantially flush with the transport surface 12. A ramp 38 as shown in figure 1 is no longer required and the tire component 9 can be supported and clamped by the alternative clamping device 203 in a substantially level condition.

C L A I M S

1. Tire building machine for centering a tire component, comprising a supply conveyor for transporting a tire component in a supply direction, a centering device for centering the tire component with respect to a center line parallel to the supply direction as the tire component is being transported in the supply direction and a clamping device for clamping the tire component during at least a part of the centering, wherein the supply conveyor is provided with a transport surface which is arranged for moving in the supply direction and for supporting the tire component during the transport in said supply direction, wherein the clamping device comprises a clamping member for clamping a part of the tire component, wherein the clamping member is arranged to move together with the transport surface in the supply direction, wherein the clamping member is further arranged for freely following the part of the tire component to which it is clamped in a floating direction that is substantially parallel to the transport surface and transverse to the supply direction.

2. Tire building machine according to claim 1, wherein the floating direction is perpendicular or substantially perpendicular to the supply direction.

3. Tire building machine according to claim 1 or 2, wherein the clamping member is arranged to be movable in translation in the floating direction.

4. Tire building machine according to any one of the preceding claims, wherein the clamping member is arranged for passively following the part of the tire component to which it is clamped in the floating direction.

5. Tire building machine according to any one of the preceding claims, wherein the tire component is provided with a leading end facing in the supply direction and a trailing end facing in a direction opposite to the supply

direction, wherein the centering device is arranged for progressively centering the tire component from its leading end towards its trailing end, wherein the clamping member is arranged to clamp the trailing end.

6. Tire building machine according to claim 5, wherein the tire building machine is provided with a retaining element for retaining the leading end of the tire component while the trailing end is clamped by the clamping device.

7. Tire building machine according to any one of the preceding claims, wherein the clamping device comprises a floating base member for supporting the clamping member and a fixed base member for supporting the floating base member, wherein the fixed base member is arranged to be moved together with the transport surface in the supply direction and wherein the floating base member is arranged to be movable in the floating direction with respect to the fixed base member.

8. Tire building machine according to claim 7, wherein the transport surface is arranged to be movable in the supply direction, wherein the fixed base member is arranged to be coupled to the transport surface so as to be movable in unison with the transport surface in the supply direction.

9. Tire building machine according to claim 8, wherein the supply conveyor comprises an endless belt, wherein the transport surface is formed by the upper run of the endless belt.

10. Tire building machine according to claim 8 or 9, wherein the fixed base member is arranged to be coupled to the transport surface by fasteners.

11. Tire building machine according to claim 8 or 9, wherein the fixed base member is arranged to be coupled to the transport surface by friction or adhesion.

12. Tire building machine according to claim 6, wherein the supply conveyor is provided with a conveyor drive for driving the supply conveyor in the supply

direction, wherein the tire building machine is further provided with a clamp drive for driving the movement of the fixed base member in the supply direction, wherein the clamp drive is operationally coupled to the conveyor drive for synchronizing the speed of the driven movement of the fixed base member with the speed of the supply conveyor in the supply direction.

13. Clamping device according to claim 1, for use in the tire building machine according to claim 1.

14. Method for centering a tire component, wherein the method comprises the steps of:

- transporting the tire component on a transport surface of a supply conveyor in a supply direction;
- centering the tire component with a centering device with respect to a center line parallel to the supply direction as the tire component is being transported in the supply direction; and
- clamping the tire component with a clamping device during at least a part of the centering;

wherein the clamping device comprises a clamping member for clamping a part of the tire component, wherein the clamping member is arranged to move together with the transport surface in the supply direction, wherein the clamping member further freely follows the part of the tire component to which it is clamped in a floating direction that is substantially parallel to the transport surface and transverse to the supply direction.

15. Method according to claim 14, wherein prior to the step of transporting the tire component on the transport surface of the supply conveyor in the supply direction, the method comprises the steps of:

- positioning the clamping device into a starting position at a distance from the centering device in the supply direction, which distance is dependent on the length of the tire component in the supply direction;
- receiving the tire component on the transport surface between the centering device and the clamping

device.

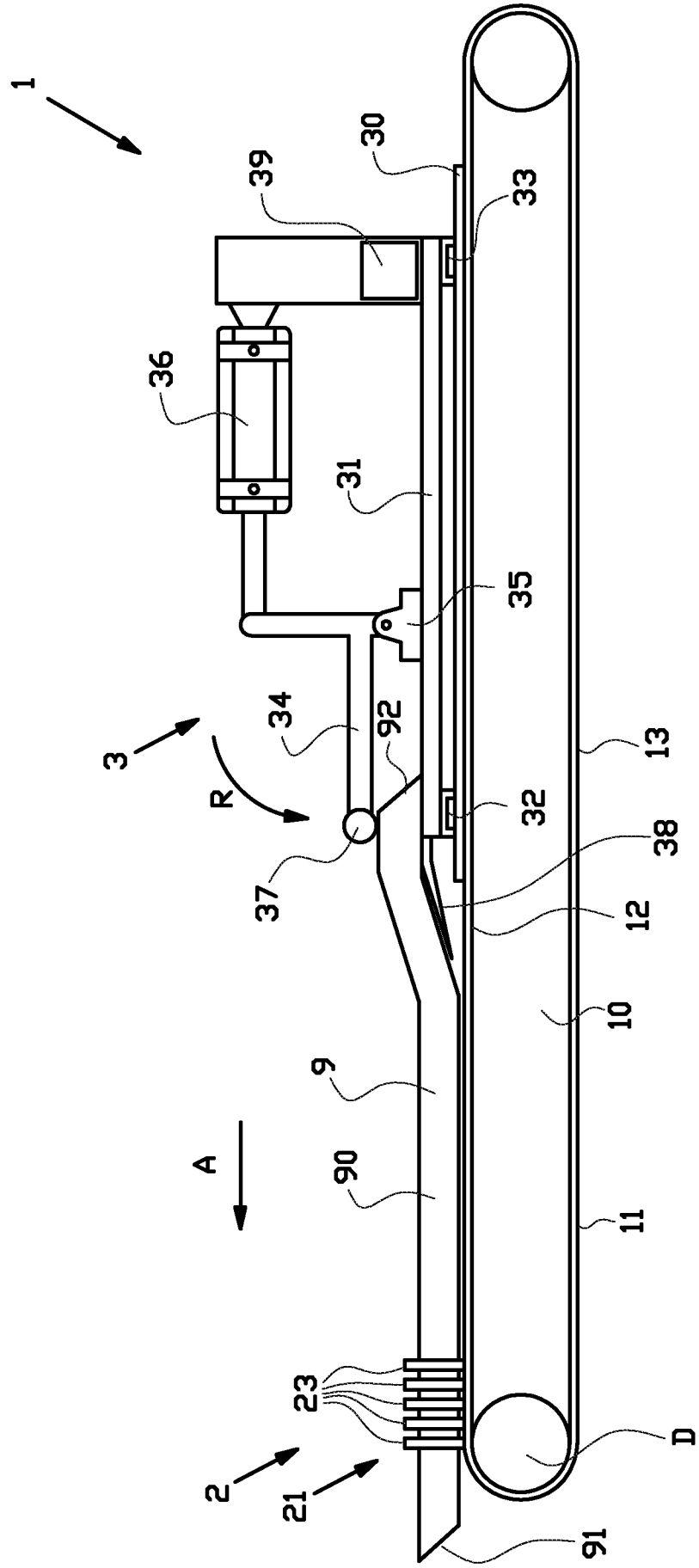


FIG. 1

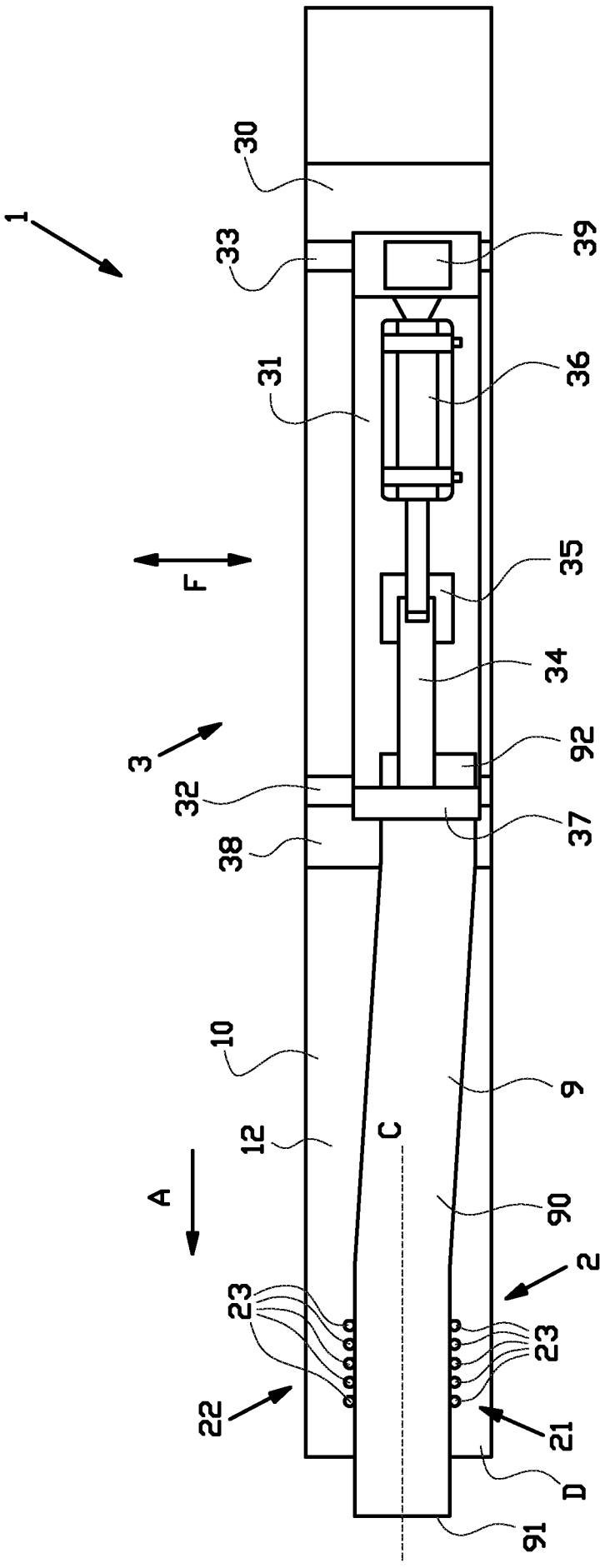


FIG. 2

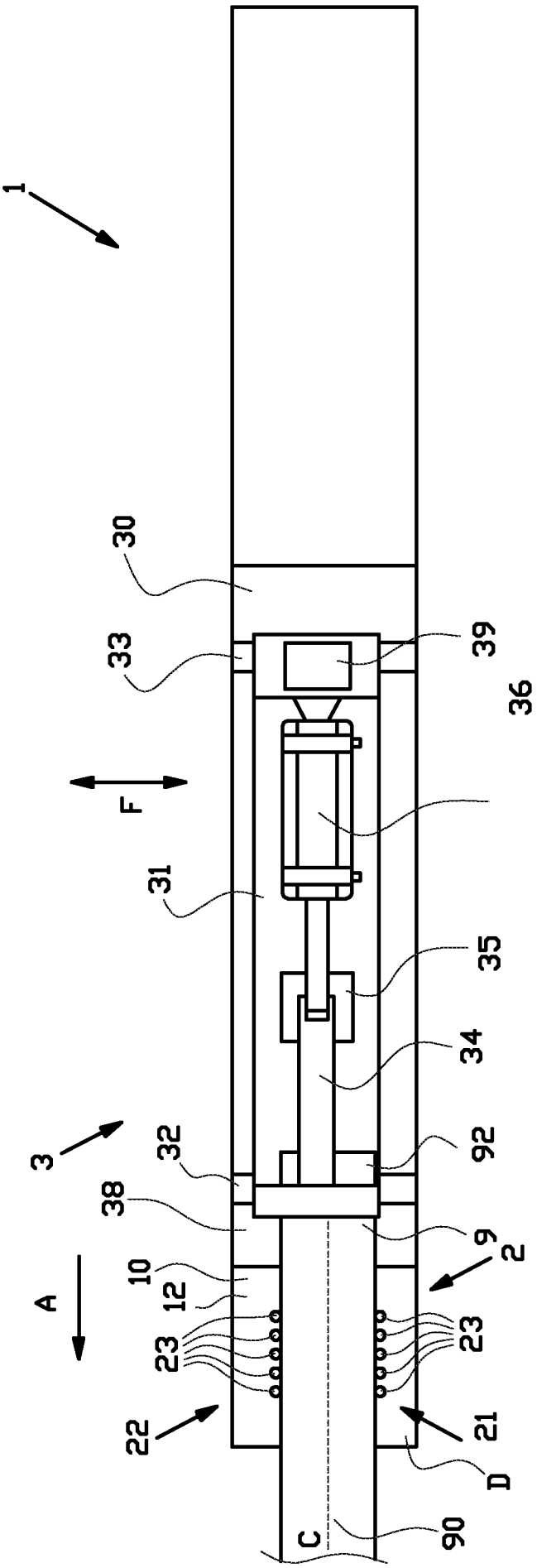


FIG. 3

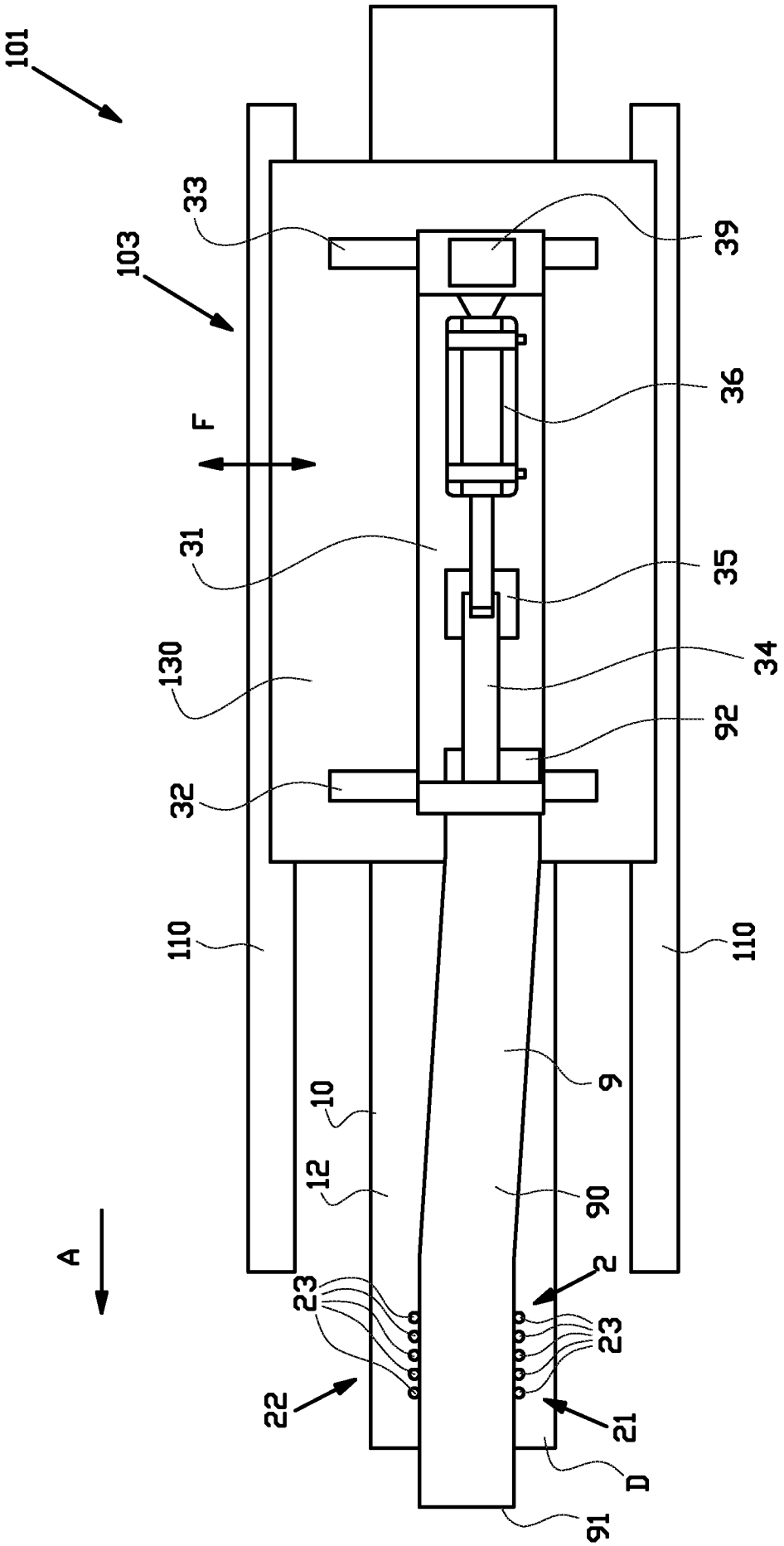

101
103
33
39
36
F
31
35
130
34
92
32
110
110
10
9
12
90
A
2
23
23
22
21
D
91

FIG. 4

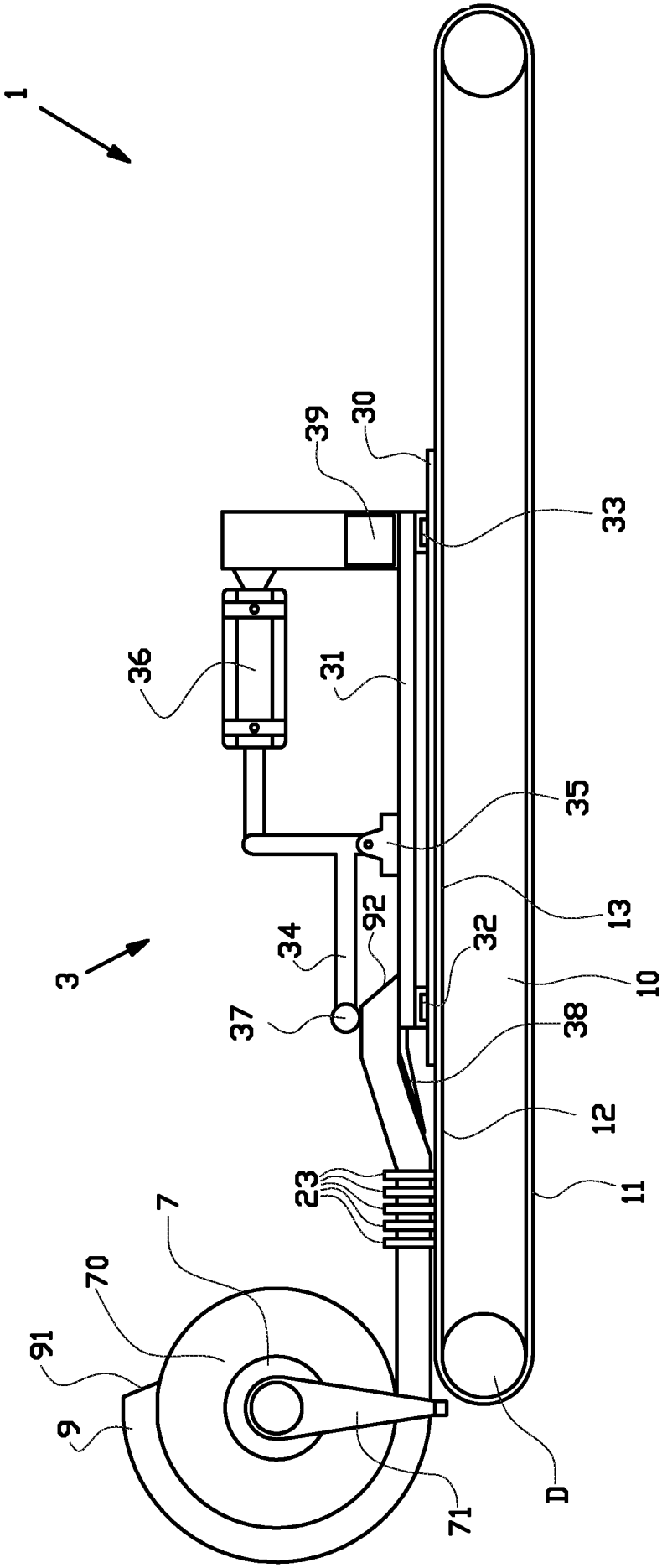


FIG. 5

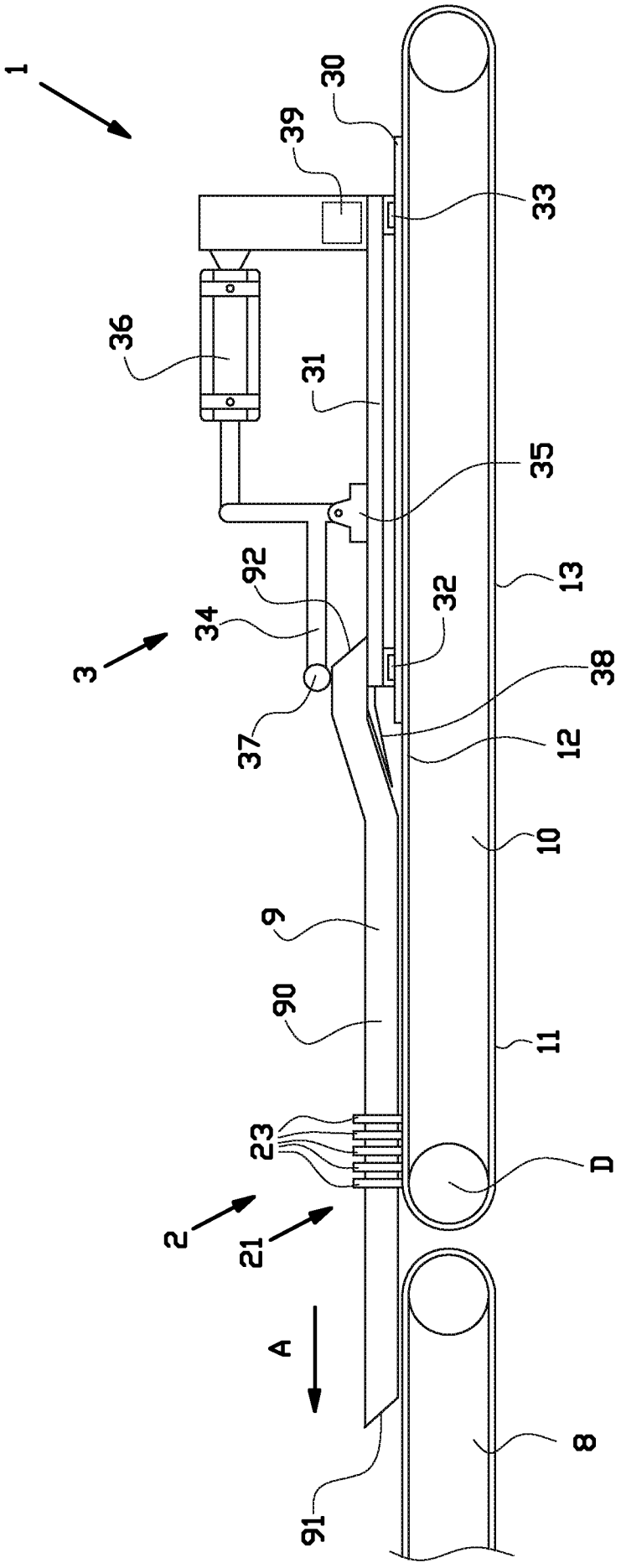


FIG. 6

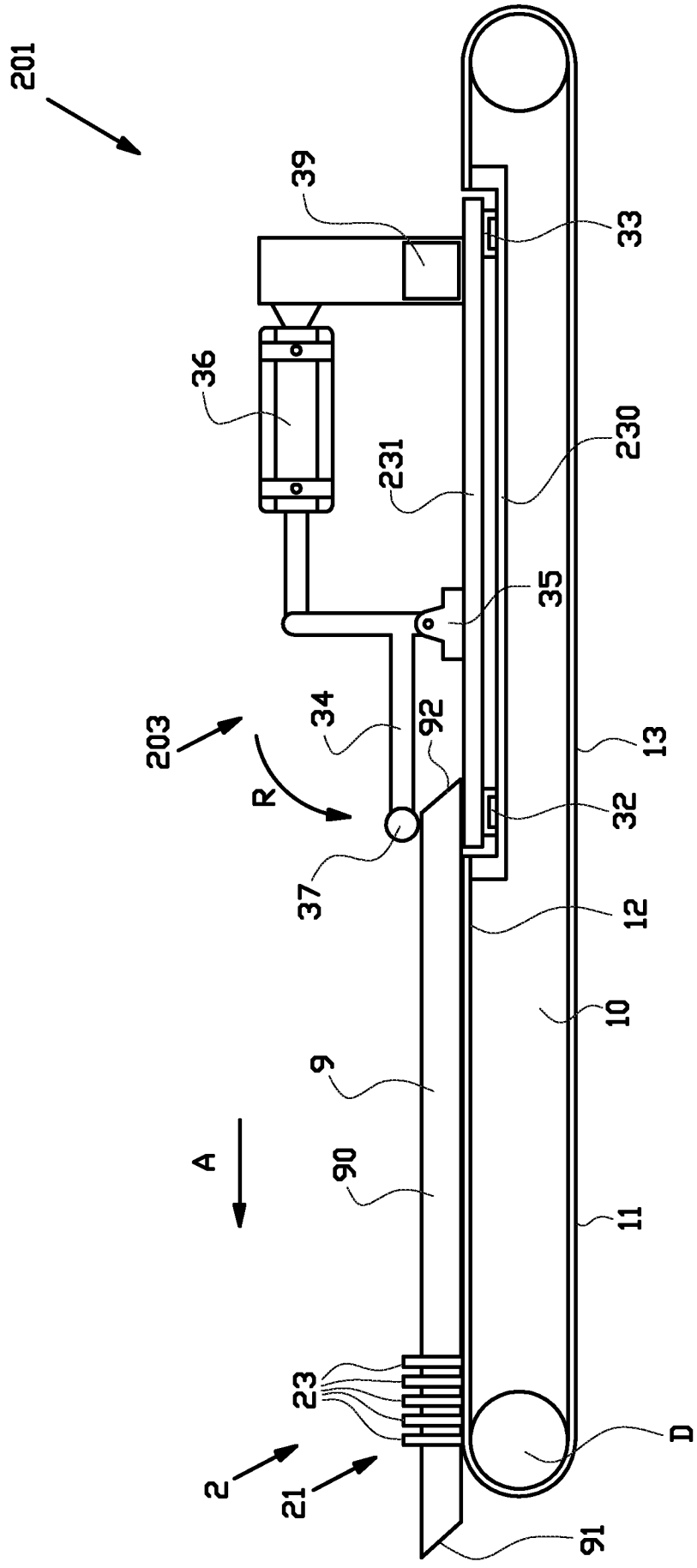


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2015/050400

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29D30/44
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 049 486 A (HENLEY VIRGIL E) 20 September 1977 (1977-09-20) cited in the application column 3, line 10 - column 4, line 37 column 5, line 50 - line 63; figures 1-8	1-15
A	US 5 175 930 A (OKUYAMA KOJI [JP] ET AL) 5 January 1993 (1993-01-05) column 6, line 37 - column 10, line 27; figures 1,4	1-15
A	US 5 318 655 A (MIYAMOTO YOSHINORI [JP] ET AL) 7 June 1994 (1994-06-07) column 3, line 20 - column 4, line 46; figures 2-5	1-15

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 September 2015	09/10/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fregosi, Alberto

1

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2015/050400

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 109 475 A2 (FIRESTONE TIRE & RUBBER CO [US]) 30 May 1984 (1984-05-30) page 6, line 14 - line 22; figure 2 page 10, line 22 - page 11, line 6	1-15
A	US 4 386 273 A (JONES ROBERT F) 31 May 1983 (1983-05-31) column 5, line 28 - column 9, line 30; figures 1,4	1-15
A	US 4 858 505 A (STILL DONALD O [US] ET AL) 22 August 1989 (1989-08-22) column 18, line 3 - line 59; figures 25,26,28	1-15

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2015/050400

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4049486 A	20-09-1977	CA 1073792 A1	18-03-1980
		ES 452416 A1	01-12-1977
		MX 143721 A	29-06-1981
		PT 65564 A	01-10-1976
		US 4049486 A	20-09-1977
		ZA 7605051 A	27-07-1977
US 5175930 A	05-01-1993	CA 2057178 A1	08-06-1992
		DE 69119563 D1	20-06-1996
		DE 69119563 T2	19-12-1996
		EP 0490599 A2	17-06-1992
		ES 2090264 T3	16-10-1996
		JP 3190051 B2	16-07-2001
		JP H04214334 A	05-08-1992
		US 5175930 A	05-01-1993
US 5318655 A	07-06-1994	DE 69307029 D1	13-02-1997
		DE 69307029 T2	17-04-1997
		EP 0575905 A1	29-12-1993
		JP H068353 A	18-01-1994
		JP 3068333 B2	24-07-2000
		US 5318655 A	07-06-1994
EP 0109475 A2	30-05-1984	BR 8302629 A	15-05-1984
		CA 1211354 A1	16-09-1986
		DE 3376815 D1	07-07-1988
		EP 0109475 A2	30-05-1984
		ES 8403376 A1	16-06-1984
		JP S615899 B2	21-02-1986
		JP S5955733 A	30-03-1984
		MX 154311 A	30-06-1987
		NZ 203260 A	11-04-1986
		ZA 8301358 A	30-11-1983
US 4386273 A	31-05-1983	NONE	
US 4858505 A	22-08-1989	BR 8402158 A	18-12-1984
		CA 1231041 A1	05-01-1988
		DE 3479983 D1	09-11-1989
		EP 0125147 A2	14-11-1984
		ES 8600617 A1	16-01-1986
		MX 160427 A	23-02-1990
		NZ 207445 A	06-03-1987
		PH 22934 A	24-01-1989
		PT 78537 A	01-06-1984
		US 4858505 A	22-08-1989
		ZA 8401612 A	31-10-1984