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(54) **Cutting device for cutting tire components.**

(57) The invention relates to a cutting device for cutting tire components, wherein the cutting device comprises an upper cutting member and a lower cutting member, wherein the upper cutting member is arranged to be moved in a cutting plane along the lower cutting member to cut the tire component in cooperation with the lower cutting member along a cutting line, wherein the upper cutting member comprises an upper knife with an upper cutting edge that is convexly arcuate in the cutting plane with respect to the lower cutting member, wherein the upper cutting member is arranged to be moved with the arcuate upper cutting edge thereof along the lower cutting member in a rocking motion in the cutting plane, wherein the arcuate upper cutting edge has a radius and a rotation center for the rocking motion at the origin of said radius, wherein the rotation center is located outside the upper cutting member.

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Cutting device for cutting tire components

BACKGROUND

The invention relates to a cutting device for cutting tire components.

Cutting devices for cutting tire components are known in two types; guillotine cutters or disc and bar cutters. Guillotine cutters comprise an upper knife and a lower knife, each with linear cutting edges. The upper knife is moved vertically along the lower knife to make a cut in a tire component. In guillotine cutters, the cutting angle of the upper knife with respect to the lower knife is generally very small. Due to the minimal cutting angle, the pressure of the upper knife is mainly directed downwards. A large portion of the upper knife is in contact with the tire component at once. The forces involved with such downwards cutting of a tire component are relatively large and may cause the upper knife to deform, thereby resulting in an inconsistent cutting gap between the upper knife and the lower knife. The knifes of a guillotine cutter are typically reinforced or constructed out of heavy material to increase the stiffness and to counter these forces. The downwardly directed cutting forces may further deform the material of the tire component to be cut.

Disc and bar cutters comprise a disc-shaped upper knife and a bar-like lower knife. The disc-shaped upper knife runs in the longitudinal direction along the bar-like lower knife, while rotating over several revolutions to cut the tire component. The disc-shaped upper knife can be

designed to be smaller than its guillotine counterpart, while the smaller radius of the disc-shaped upper knife results in a greater cutting angle of the disc-shaped upper knife with respect to the bar-like lower knife. The contact surface between the upper knife and the tire component is considerably smaller and the increased cutting angle reduces the amount of pressure force required for cutting the tire component. The same small radius and the great cutting angle however cause a substantial amount of the pressure force to be directed horizontally, thereby causing deformations in front of the disc-shaped upper knife.

It is an object of the present invention to provide an alternative cutting device for cutting tire components.

SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a cutting device for cutting tire components, wherein the cutting device comprises an upper cutting member and a lower cutting member, wherein the upper cutting member is arranged to be moved in a cutting plane along the lower cutting member to cut the tire component in cooperation with the lower cutting member along a cutting line, wherein the upper cutting member comprises an upper knife with an upper cutting edge that is convexly arcuate in the cutting plane with respect to the lower cutting member, wherein the upper cutting member is arranged to be moved with the arcuate upper cutting edge thereof along the lower cutting member in a rocking motion in the cutting plane, wherein the arcuate upper cutting edge has a radius and a rotation center for the rocking motion at the origin of said radius, wherein the rotation center is located outside the upper cutting member.

This allows for the upper cutting member to be moved in a rocking motion about a rotation center that is not limited to the physical extents of the upper cutting

member. The radius of the arcuate upper cutting edge can thus be dimensioned to be relatively large with respect to the tire component to be cut. The arcuate upper cutting edge can therefor provide the same advantages as a disc-shaped upper knife of a conventional disc and bar cutter, e.g. reducing the contact surface of the upper knife with the tire component during cutting, while reducing the drawbacks associated with the typically small diameter and large cutting angle of such a convention disc and bar cutter.

In an preferred embodiment the arcuate upper cutting edge has a length that is less than two radians with respect to said radius, most preferably less than one radian with respect to said radius. The small length of the arcuate upper cutting edge with respect to the overall circumference can allow for a compact upper knife with a relatively large radius. The upper knife can thus be more compact or can be provided with a larger radius.

In an embodiment the cutting device comprises a guide member for guiding the rocking motion of the upper cutting member with respect to the lower cutting member. The guide member can improve the stability and repeatability of the rocking motion.

In an embodiment the upper cutting member comprises a first coupling element coupled to the upper knife, wherein the guide member is provided with a first arcuate guide element for receiving and guiding the first coupling element relative to the guide member along a first cycloid path followed by the first coupling element during the rocking motion of the upper cutting member. The interaction between the first coupling element and the first arcuate guide element improves the consistency of the rocking motion along the first cycloid path. Furthermore, the coupling between the first coupling element and the first arcuate guide element prevents that the upper knife shifts in a direction parallel to the cutting line.

In a preferred embodiment thereof the upper cutting member comprises a second coupling element coupled

to the upper knife, wherein the guide member is provided with a second arcuate guide element for receiving and guiding the second coupling element relative to the guide member along a second cycloid path followed by the second coupling element during the rocking motion of the upper cutting member. The interaction between the second coupling element and the second arcuate guide element improves the consistency of the rocking motion along the second cycloid path. Furthermore, the coupling between the second coupling element and the second arcuate guide element prevents that the upper knife shifts in a direction parallel to the cutting line.

In an embodiment the first coupling element and the second coupling element are mutually spaced apart, preferably at opposite ends of the upper knife in the direction of the rocking motion. The spacing between the coupling elements further improves the stability of the rocking motion and can allow for other components of the upper cutting member and/or the guide member to be accommodated in the spacing.

In an embodiment the upper knife is symmetrical or substantially symmetrical about the half length of the arcuate upper cutting edge, wherein the first coupling element and the second coupling element are arranged on opposite symmetrical sides of the upper knife. The upper cutting member can thus be moved symmetrically in the rocking motion between the coupling elements and their respective arcuate guide elements.

In an embodiment the cutting device is provided with an actuator for driving the rocking motion of the upper cutting member with respect to the lower cutting member. The rocking motion can thus be actively driven and/or controlled, instead of e.g. a manual actuation.

In an embodiment the actuator is coupled to the upper cutting member at a distance radially spaced apart from the rotation center of the arcuate upper cutting edge. The actuator can thus be placed in a decentralized position,

e.g. within the physical boundaries of cutting device, while the rotation center is located outside said physical boundaries.

In an embodiment the rocking motion comprises a rotation of the upper cutting member about the rotation center and a translation of the rotation center parallel to the cutting line, wherein the actuator comprises a carriage that is linearly movable parallel to the cutting line, wherein the carriage is coupled to the upper cutting member and is arranged for driving the translation of the upper cutting member while allowing the rotation of or imposing the rotation onto the cutting member about the rotation center. The carriage can be used to both drive the translation of the upper cutting member and either impose or allow the rotation of the upper cutting member.

In an embodiment the guide member comprises a linear guide, wherein the carriage is coupled to the linear guide for guided linear movement parallel to the cutting line. A linear movement can be easily controlled and/or actuated, e.g. by a linear actuator.

In an embodiment the linear guide is arranged in a fixed position with respect to the first arcuate guide element and the second arcuate guide element. The fixed relative positions of the arcuate guide elements and the linear guide can impose a restricted freedom of movement onto the upper cutting member that is both coupled to the arcuate guide elements and indirectly supported on the linear guide by the carriage.

In an embodiment the actuator is further provided with a timing belt for driving the carriage in the translation direction along the linear guide. The timing belt can effectively control the amount of translation of the carriage along the linear guide.

In an embodiment the carriage is coupled to the upper cutting member at a radius of the arcuate upper cutting edge that is normal to the cutting line. Thus, the carriage can be located very near to and/or parallel to the

cutting line.

In an embodiment the upper cutting member is slidable with respect to the carriage in a direction tangential to the arcuate upper cutting edge. The upper cutting member can thus be rotated in the tangential direction and/or the direction of the curvature or arc of the arcuate upper cutting edge.

In an embodiment the upper cutting member is provided with an arcuate rail that is coupled to and concentric to the arcuate upper cutting edge, wherein the actuator comprises a guide shoe that is arranged for slidably receiving or engaging the arcuate rail. The guide shoe can support the upper cutting member relative to the carriage at the radial position of the arcuate rail, while allowing for the aforementioned sliding of the arcuate rail, and thus of the upper cutting member, relative to the carriage.

In an embodiment the rocking motion comprises a rotation of the cutting member about a rotation center and a translation of said rotation center parallel to the cutting line, wherein the circumferential speed of the rotation is substantially equal to the translational speed of the translation. This can reduce slip occurring between the upper cutting member and the lower cutting member.

In an embodiment the upper cutting member overlaps the lower cutting member parallel to or in the cutting plane in a direction normal to the cutting line. The overlap can improve the quality of the cutting.

In a preferred embodiment thereof the overlap between the upper cutting member and the lower cutting member defines a cutting depth, wherein the cutting depth is arranged to remain constant during the rocking motion. As the cutting depth remains constant, the cutting angle can be kept relatively constant as well. This can improve the consistency of the pressure forces occurring between the upper cutting member, the lower cutting member and/or the tire component during the cutting.

In an embodiment the upper cutting member intersects with the lower cutting member at the overlap at a cutting angle that is less than ten degrees, preferably less than five degrees. The small cutting angle can reduce the amount of pressure force being exerted by the upper cutting member on the tire component in a direction parallel to the cutting line, thereby reducing deformations as a result of said pressure force.

In a preferred embodiment the lower cutting member comprises a lower knife, preferably a bar-like lower knife, with a rectilinear lower cutting edge.

In a preferred embodiment the lower cutting member is arranged to be positioned with its rectilinear lower cutting edge extending horizontally or substantially horizontally.

In an embodiment the arcuate upper cutting edge is circular. The circularity of the arcuate upper cutting edge can improve the consistency of the cutting angle throughout the cutting.

According to a second aspect, the invention provides a method for cutting tire components with the use of the cutting device according to any one of the preceding claims, wherein the method comprises the step of moving the upper cutting member with the arcuate upper cutting edge thereof along the lower cutting member in a rocking motion in the cutting plane.

Again, the arcuate upper cutting edge can provide the same advantages as a disc-shaped upper knife of a conventional disc and bar cutter, e.g. reducing the contact surface of the upper knife with the tire component during cutting, while reducing the drawbacks associated with the typically small diameter and large cutting angle of such a convention disc and bar cutter. In particular, the small length of the arcuate upper cutting edge with respect to the overall circumference can allow for a compact upper knife with a relatively large radius.

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 show a front view of the cutting device according to the invention;

figure 2 show a cross sectional side view of the cutting device according to the line II-II in figure 1; and

figures 3 and 4 show front views of the cutting device in two operational positions according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1 and 2 show a cutting device 1 for cutting tire components according to an exemplary embodiment of the invention.

The cutting device 1 comprises an upper cutting member 2, a guide member 3, a lower cutting member 4 and an actuator 5. As shown in figure 2, the upper cutting member 2 is movable in a cutting plane V along the lower cutting member 4 for cutting one or more of the tire components in cooperation with the lower cutting member 4. Preferably, as in figures 1 and 2, the cutting device 1 is carefully positioned on a factory floor such that the movement of the upper cutting member 2 is a movement in a vertical or substantially vertical cutting plane V. As best seen in figures 3 and 4, the upper cutting member 2 is arranged to

be moved in a reciprocating rolling or rocking motion along the lower cutting member 4 in a manner that will be specified hereafter.

The upper cutting member 2 comprises an upper knife 20 with an upper cutting edge 21 extending between a first end 22 and a second end 23 of the upper knife 20. The upper cutting edge 21, when projected in a normal direction N onto the cutting plane V, is curved or arcuate. The curvature or arc of the upper cutting edge 21 convexly faces the lower cutting member 4, meaning that its radial outer side is facing towards the lower cutting member 4 in the cutting plane V or a direction parallel to the cutting plane V. In this exemplary embodiment, the curvature or arc of the arcuate upper cutting edge 21 is a segment of a virtual circle. As such, the curvature or arc of the arcuate upper cutting edge 21 has constant radii R1, R2 between the ends 22, 23 of the upper knife 20 and a rotation center C at the origin of said radii R1, R2. The radii R1, R2 are considerably larger, preferably at least a factor of five and most preferably at least a factor of ten, than the radius of the cutting disc of a conventional disc and bar cutter. In the figures, the radii R1, R2 are schematically shortened by break lines to save space in the drawings.

Alternatively, the curvature or arc can be a segment of an ellipsoid or a segment of another curvature, in which case the upper cutting edge has at least two points with radii R1, R2 that intersect in a rotation center C. An ellipsoid segment is less favorable because of the varying radii along the length of the segment, which causes a varying pressure force when the segment runs over the tire component.

In this exemplary embodiment, the radially inner edge of the body of the upper knife 20 is concentrically formed with respect to the arc of the arcuate upper cutting edge 21, such that the contour of the upper knife 20 resembles a segment of an annulus or ring with a limited radial thickness. In particular, it can be observed that the

body of the knife 20 does not extend up to or intersect with the rotation center C of the arc or that the rotation center C is located outside the body 20 of the upper knife 20. At least one of the sides of the body of the upper knife 20, in particular the side facing away from the cutting plane V and the lower cutting member 4, is provided with a beveled face tapering towards the arcuate upper cutting edge 21.

As shown in figure 1, the arcuate upper cutting edge 21 has a length L between the ends 22, 23 of the upper knife 20 that is less than two radians, and preferably less than one radian with respect to the radii R1, R2. In this exemplary embodiment, the length L of the arcuate upper cutting edge 21 is approximately 0.6 to 0.7 radians with respect to the radii R1, R2.

The upper cutting member 2 further comprises a first coupling element 24 and a second coupling element 25 coupled to the body of the upper knife 20 at or near the respective first end 22 and second end 23. In particular, the upper knife 20 is symmetrical or substantially symmetrical with respect to the halfway point of the length L of the arcuate upper cutting edge 21, wherein the first coupling element 24 and the second coupling element 25 are arranged on opposite symmetrical sides of the upper knife 20. In this exemplary embodiment, the coupling elements 24, 25 are in the form of pins projecting from the upper knife 20 towards the guide member 3.

As shown in figures 1 and 2, the upper cutting member 2 is further provided with an arcuate rail 26 that is coupled to the side of the knife body of the upper knife 20 that faces towards the cutting plane V and/or the guide member 3. The arcuate rail 26 extends at the same curvature or arc or is concentric to the arcuate upper cutting edge 21. In this exemplary embodiment, the arcuate rail 26 is positioned radially in the middle of the radial thickness of the knife body of the upper knife 20. The arcuate rail 26 extends along a substantial part of the length L and preferably the entire length L of the upper knife 20.

As best seen in figure 1, the guide member 3 comprises a guide plate 30 extending behind the upper cutting member 2 and above the lower cutting member 4. As shown in figure 2, the guide plate 30 extends parallel to the cutting plane V. The guide member 3 is provided with a first arcuate guide element 31 and a second arcuate guide element 32 in the form of separate slots in the guide plate 30. The first arcuate guide element 31 and the second arcuate guide element 32 extend along a first cycloid path P1 defined or followed by the first coupling element 24 and a second cycloid path P2 defined followed by the second coupling element 25 as these coupling elements 24, 25 move or travel relative to the guide member 3 as a result of the rocking motion of the upper cutting member 2 relative to said guide member 3. The first arcuate guide element 31 and the second arcuate guide element 32 are arranged for receiving, engaging and/or guiding the first coupling element 24 and the second coupling element 24, respectively, along their respective cycloid paths P1, P2.

Alternatively, the arcuate guide elements 31, 32 may be formed as ridges (not shown) extending along the respective cycloid paths P1, P2 and the coupling elements 24, 25 may be formed as hooks (not shown) hooking behind or engaging with the ridges of the respective arcuate guide elements 31, 32.

As shown in figure 1, the guide member 3 further comprises a linear guide 33, preferably in the form of a set of parallel rails, which extends parallel to the cutting line V in or along the guide plate 30 and between the arcuate guide elements 31, 32. The linear guide 33 is located at the bottom of the guide plate 30, near the lower cutting member 4 and intersects with the guide rail 26 of the upper knife 20 when viewed in the normal direction N of the cutting plane V. The mutual positions of the linear guide 33 with respect to the first arcuate guide element 31 and the second arcuate guide element 32 are fixed, at least during the cutting.

As shown in figure 2, the upper cutting member 2 and the lower cutting member 4 are arranged at opposite sides of the cutting plane V. The lower cutting member 4 comprises a lower, bar-like knife 40 with an elongate, bar-like body extending parallel to and in close proximity to the cutting plane V. The lower knife 40 is provided with a rectilinear lower cutting edge 41 facing the upper knife 20 at the opposite side of the cutting plane V. The lower cutting edge 41 defines a rectilinear cutting line S along which the tire components are cut. The cutting device 1, and in particular the lower cutting member 4, is arranged to be positioned relative to a factory floor such that the rectilinear lower cutting edge 41 extends horizontally or substantially horizontally.

During the cutting, the upper knife 20 overlaps the lower knife 40 parallel to and/or in the cutting plane V in a vertical direction normal or perpendicular to the cutting line S. In particular, the arcuate upper cutting edge 21 intersects with the rectilinear lower cutting edge 41 at the cutting line S and overlaps said lower cutting edge 41 by a cutting depth Z. The cutting depth Z is arranged to remain constant during the rocking motion. The angle between the arcuate upper cutting edge 21 and the rectilinear lower cutting edge 41 at the intersection or cutting point between the cutting edges 21, 41 defines a cutting angle A. The cutting angle A is less than ten degrees, and preferably even less than five degrees.

The actuator 5 comprises a carriage 50 that is movably mounted on or coupled to the linear guide 33 of the guide member 3 so as to be slidable or movable along the linear guide 33 in a translation T1, T2 parallel to the cutting line S. The actuator 5 is provided with two guide shoes 51 which are coupled to the carriage 50 to move in translation T1, T2 in unison with the carriage 50 along the linear guide 33. The guide shoes 51 are arranged for slidably receiving and/or engaging the arcuate guide rail 26 of the upper cutting member 2 at a radius of the arcuate

guide rail 26 and/or the arcuate upper cutting edge 21 that is normal to the cutting line S. The guide shoes 51 are arranged for supporting the upper cutting member 2 relative to the carriage 50 and/or the lower cutting member 4 at a constant cutting depth Z. At the point where the guide shoes 51 interact with said arcuate guide rail 26, the guide shoes 51 are placed in an orientation tangential to the curvature or arc of the arcuate guide rail 26 for allowing a sliding movement of the arcuate guide rail 26 through the guide shoes 51 and relative to the carriage 50 in a direction tangential to or in the curvature or arc of the arcuate guide rail 26 and/or the arcuate upper cutting edge 21. With the use of the guide shoes 51, the carriage 50 can thus be coupled to the upper cutting member 2 at the arcuate guide rail 26 thereof, while allowing a sliding rotation M1, M2 of the upper cutting member 2 relative to the carriage 50 about the rotation center C of the arcuate upper cutting edge 21.

As shown in figure 1, the actuator 5 further comprises a timing belt 52 that is mounted to the guide member 3 and extends along the linear guide 33. The timing belt 52 is coupled to the carriage 50 for driving the carriage 50 in a movement parallel to the cutting line S along the linear guide 33.

The method for cutting a tire component with the use of the aforementioned cutting device 1 will be described hereafter with reference to figures 1-4.

As shown in figures 1 and 2, the upper cutting member 2 is in a neutral position with both ends 22, 23 of the upper knife 20 symmetrically at the same height. From this neutral position, the upper cutting member 2 can be moved in the aforementioned rocking motion to and fro two end positions as shown in figures 3 and 4, respectively. The end positions are defined by the freedom of movement of the coupling elements 24, 25 within the boundaries of the arcuate paths P1, P2.

The rocking motion comprises a combination of the rotation M1, M2 of the upper cutting member 2 about the

rotation center C and a translation T1, T2 of the rotation center C parallel to the cutting line S. The translation T1, T2 of the rotation center C is driven by the actuator 5, in particular by the carriage 50 thereof. It can be observed that the carriage 50, during the translation T1, T2, remains vertically below the rotation center C and always engages the upper knife 20 at the radius with respect to the rotation center C that is normal to the cutting line S. The rotation M1, M2 is imposed on the upper cutting member 2 by the driven translation T1, T2, which - through the restricted freedom of movement of the upper cutting member 2 with respect to the arcuate guide elements 31, 32 and the guide shoes 51 - is converted into a sliding rotation M1, M2 of the arcuate guide rail 26 through the guide shoes 51 about the rotation center C. Effectively, the carriage 50 pulls the respective ends 22, 23 of the upper knife 20, towards which the carriage 50 is moved in translation T1, T2, downwards.

It is further noted that in the event of a slipless rolling motion, the circumferential velocity or speed of the rotation M1, M2 is substantially equal to the translational velocity or speed of the translation T1, T2.

To initiate the cutting, the upper cutting member 2 is moved in the aforementioned rocking motion to one of the end positions as shown in figure 3 or 4, thereby clearing a center area for insertion of a tire component (not shown) between the upper cutting member 2 and the lower cutting member 4 in a horizontal supply direction X. With the tire component inserted between the upper cutting member 2 and the lower cutting member 4, the upper knife 20 of the upper cutting member 2 is rocked in the aforementioned manner to the opposite end position.

As the upper cutting member 2 rocks towards the opposite end position, the intersection of the arcuate upper cutting edge 21 with the linear lower cutting edge 41 at the cutting line S travels in translation T1, T2 while cutting through the tire component. The length of the arcuate

cutting edge L is such that the tire component can be fully cut within the rocking motion of the upper cutting member 2, while requiring only a small angle of rotation M1, M2 to affect said rocking motion, e.g. less than 60 angular degrees or preferably even less than 30 angular degrees. Because of the arcuate upper cutting edge 21 being a circular segment and the cutting depth Z remaining constant, the cutting angle A remains constant as well throughout the cutting. The cutting angle A is very small with respect to the cutting angle of a conventional disc and bar cutter. Particularly, the cutting angle A approaches or equals the minimal cutting angle of a conventional guillotine cutter. Due to the small cutting angle A, the pressure forces exerted on the tire component during the cutting are mainly directed downwards, thereby preventing any substantial pressure force to be directed in the horizontal plane. Thus, deformation of the tire component in front of the upper cutting member 2 can be reduced.

Meanwhile, the rocking motion allows for a more gradual distribution of the pressure force and better control of said pressure force during the cutting, thereby allowing for a lighter upper cutting member 2 with respect to the relatively heavy upper knife of a conventional guillotine cutter. The reduced and more constant pressure force also allows for better control of the cutting gap between the cutting members 2, 4.

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 scope of the present invention.

C O N C L U S I E S

1. Snijinrichting voor het snijden van bandcomponenten, waarbij de snijinrichting een bovensnijdeel en ondersnijdeel omvat, waarbij het bovensnijdeel is ingericht teneinde bewogen te worden in een snijvlak langs het ondersnijdeel teneinde de bandcomponent te snijden in samenwerking met het ondersnijdeel langs een snijlijn, waarbij het bovensnijdeel een bovenmes omvat met een bovensnijrand die convex gekromd is in het snijvlak ten opzichte van het ondersnijdeel, waarbij het bovensnijdeel is ingericht teneinde bewogen te worden met de gekromde bovensnijrand daarvan langs het ondersnijdeel in een schommelbeweging in het snijvlak, waarbij de gekromde bovensnijrand een radius heeft en een rotatiecentrum voor de schommelbeweging bij de oorsprong van de radius, waarbij het rotatiecentrum buiten het bovensnijdeel gelegen is.

2. Snijinrichting volgens conclusie 1, waarbij de gekromde bovensnijrand een lengte heeft die minder is dan twee radialen ten opzichte van de radius.

3. Snijinrichting volgens conclusie 2, waarbij de lengte van de gekromde bovensnijrand minder is dan één radiaal ten opzichte van de radius.

4. Snijinrichting volgens een der voorgaande conclusies, waarbij de snijinrichting een geleidingsdeel omvat voor het begeleiden van de schommelbeweging van het bovensnijdeel ten opzichte van het ondersnijdeel.

5. Snijinrichting volgens conclusie 4, waarbij het bovensnijdeel een eerste koppelelement omvat dat gekoppeld is met het bovenmes, waarbij het geleidingsdeel is voorzien van een eerste gekromd geleidingselement voor het ontvangen en geleiden van het eerste koppelelement relatief ten opzichte van het geleidingsdeel langs een

eerste cycloïde baan die gevolgd wordt door het eerste koppelelement gedurende de schommelbeweging van het bovensnijdeel.

6. Snijinrichting volgens conclusie 5, waarbij het bovensnijdeel een tweede koppelelement omvat dat gekoppeld is met het bovenmes, waarbij het geleidingsdeel is voorzien van een tweede gekromd geleidingselement voor het ontvangen en geleiden van het tweede koppelelement relatief ten opzichte van het geleidingsdeel langs een tweede cycloïde baan die gevolgd wordt door het tweede koppelelement gedurende de schommelbeweging van het bovensnijdeel.

7. Snijinrichting volgens conclusie 6, waarbij het eerste koppelelement en het tweede koppelelement onderling op afstand van elkaar gelegen zijn, bij voorkeur aan tegengestelde uiteinden van het bovenmes in de richting van de schommelbeweging.

8. Snijinrichting volgens conclusie 6 of 7, waarbij het bovenmes symmetrisch of in hoofdzaak symmetrisch is rond de helft van de lengte van de gekromde bovensnijrand, waarbij het eerste koppelelement en het tweede koppelelement zijn aangebracht op tegengestelde symmetrische zijden van het bovenmes.

9. Snijinrichting volgens een der voorgaande conclusies, waarbij de snijinrichting is voorzien van een actuator voor het aandrijven van de schommelbeweging van het bovensnijdeel ten opzichte van het ondersnijdeel.

10. Snijinrichting volgens conclusie 9, waarbij de actuator is gekoppeld met het bovensnijdeel radiaal op afstand gelegen van het rotatiecentrum van de gekromde bovensnijrand.

11. Snijinrichting volgens conclusie 9 of 10, waarbij de schommelbeweging een rotatie van het bovensnijdeel rond het rotatiecentrum en een translatie van het rotatiecentrum evenwijdig aan de snijlijn omvat, waarbij de actuator een wagen omvat die lineair beweegbaar is evenwijdig aan de snijlijn, waarbij de wagen is

gekoppeld met het bovensnijdeel en is ingericht voor het aandrijven van de translatie van het bovensnijdeel terwijl rotatie wordt toegelaten van of rotatie wordt opgelegd aan het snijdeel rond het rotatiecentrum.

12. Snijinrichting volgens conclusies 4 en 11, waarbij het geleidingsdeel een lineaire geleiding omvat, waarbij de wagen is gekoppeld met de lineaire geleiding voor een begeleide lineaire beweging evenwijdig aan de snijlijn.

13. Snijinrichting volgens conclusies 5 of 6 en conclusie 13, waarbij de lineaire geleiding is aangebracht in een vaste positie ten opzichte van het eerste gekromde geleidingselement en/of het tweede gekromde geleidingselement.

14. Snijinrichting volgens conclusie 12 of 13, waarbij de actuator verder is voorzien van een distributieketting voor het aandrijven van de wagen in de translatierichting langs de lineaire geleiding.

15. Snijinrichting volgens een der conclusies 11 tot en met 14, waarbij de wagen gekoppeld is met het bovensnijdeel op een radius van een gekromde bovensnijrand welke normaal is ten opzichte van de snijlijn.

16. Snijinrichting volgens een der conclusies 11 tot en met 15, waarbij het bovensnijdeel schuifbaar is ten opzichte van de wagen in een richting tangentiaal aan de gekromde bovensnijrand.

17. Snijinrichting volgens een der conclusies 11 tot en met 16, waarbij het bovensnijdeel is voorzien van een gekromde rail die is gekoppeld met en concentrisch is aan de gekromde bovensnijrand, waarbij de actuator een geleidingsschoen omvat die is ingericht voor het schuifbaar ontvangen van en het aangrijpen op de gekromde rail.

18. Snijinrichting volgens een der voorgaande conclusies, waarbij de schommelbeweging een rotatie van het snijdeel rond een rotatiecentrum en een translatie van het rotatiecentrum evenwijdig aan de snijlijn omvat, waarbij de omtreksnelheid van de rotatie in hoofdzaak gelijk is aan de

translatiesnelheid van de translatie.

19. Snijinrichting volgens een der voorgaande conclusies, waarbij het bovensnijdeel het ondersnijdeel overlapt evenwijdig aan of in het snijvlak in een richting normaal ten opzichte van de snijlijn.

20. Snijinrichting volgens conclusie 19, waarbij de overlap tussen het bovensnijdeel en het ondersnijdeel een snijdiepte bepaalt, waarbij de snijdiepte is ingericht teneinde constant te blijven gedurende de schommelbeweging.

21. Snijinrichting volgens conclusie 19 of 20, waarbij het bovensnijdeel het ondersnijdeel kruist bij de overlap met een snijhoek die minder is dan tien graden en bij voorkeur minder dan vijf graden.

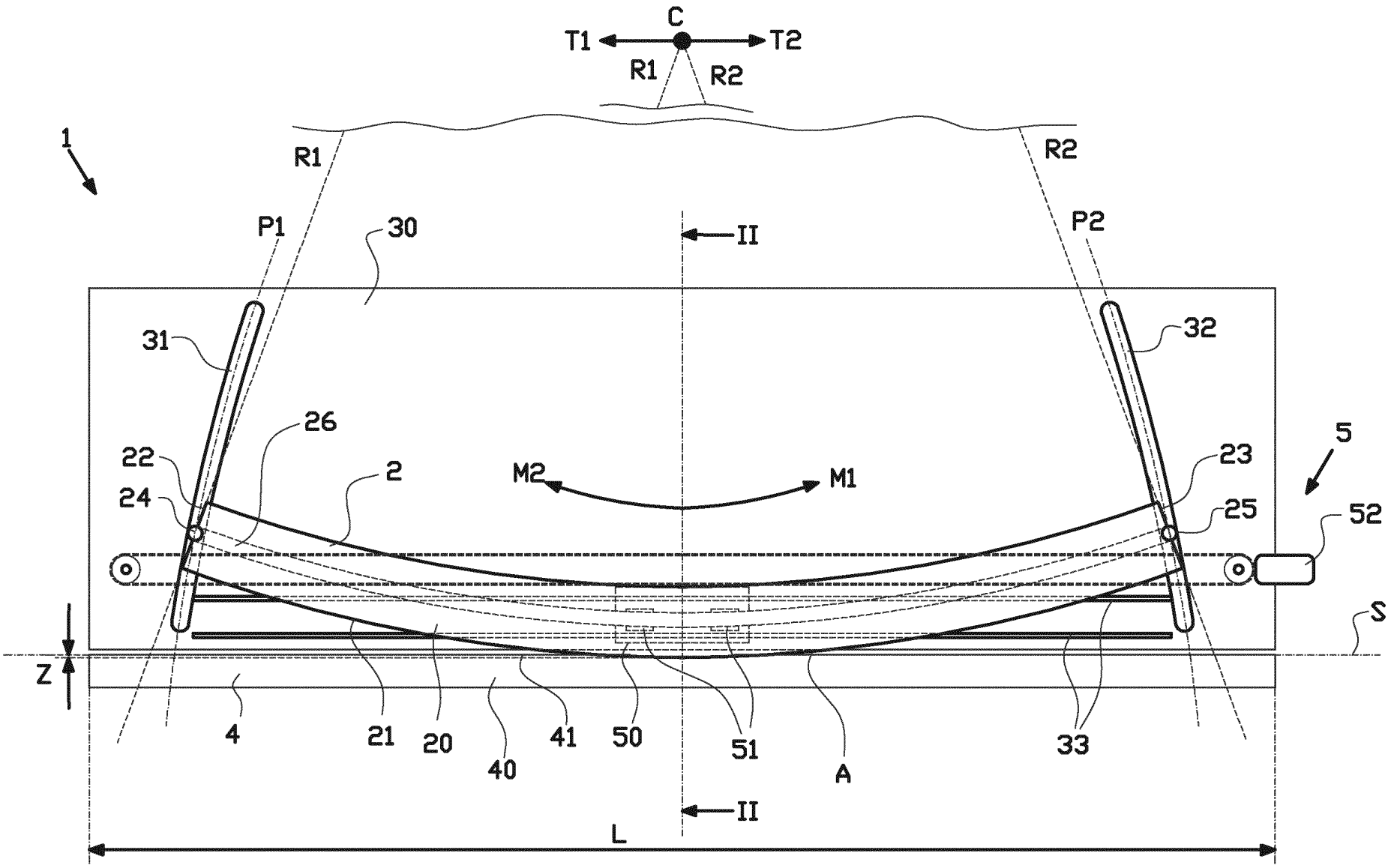
22. Snijinrichting volgens een der voorgaande conclusies, waarbij het ondersnijdeel een ondermes omvat, bij voorkeur een balkachtig ondermes, met een rechtlijnige ondersnijrand.

23. Snijinrichting volgens conclusie 22, het ondersnijdeel is ingericht teneinde gepositioneerd te worden met de rechtlijnige ondersnijrand daarvan zich horizontaal of in hoofdzaak horizontaal uitstrekkend.

24. Snijinrichting volgens een der voorgaande conclusies, waarbij de gekromde bovensnijrand cirkelvormig is.

25. Werkwijze voor het snijden van bandcomponenten met gebruikmaking van de snijinrichting volgens een der voorgaande conclusies, waarbij de werkwijze de stap omvat van het bewegen van het bovensnijdeel met de gekromde bovensnijrand daarvan langs het ondersnijdeel in een schommelbeweging in het snijvlak.

-o-o-o-o-o-o-o-o-


C
T1
T2
R1
R2
1
R1
R2
P1
30
II
P2
31
32
26
22
2
M2
M1
23
5
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25
52
S
Z
4
21
20
40
41
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A
33
II
L

FIG. 1

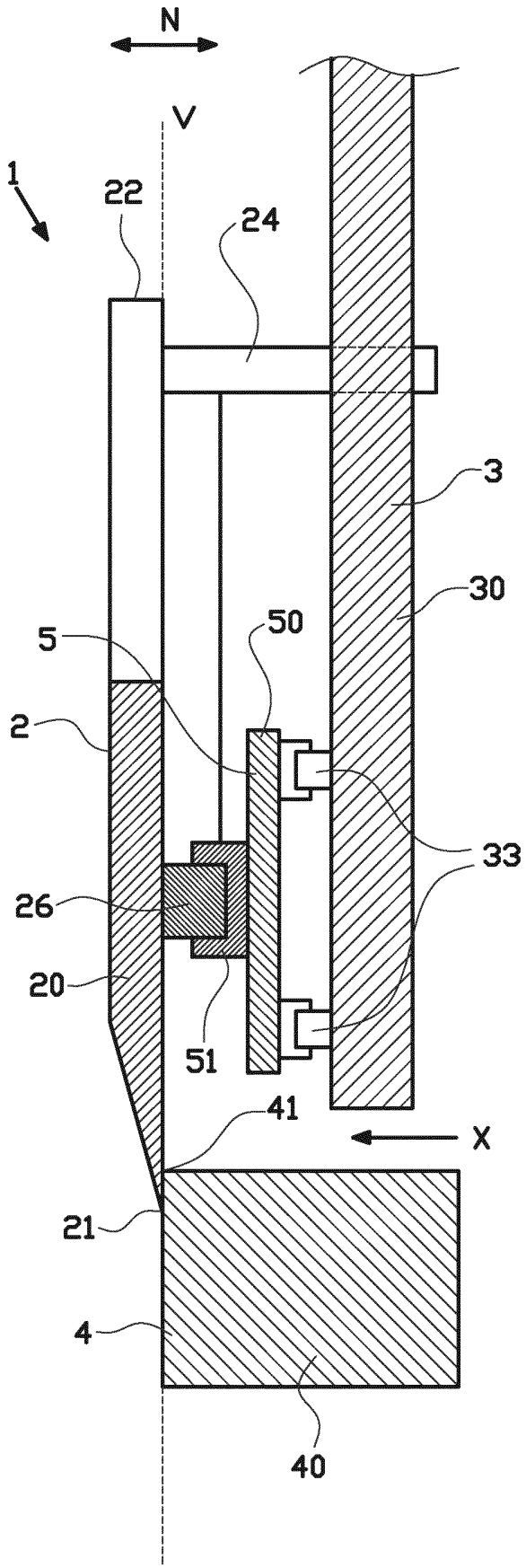

FIG. 2

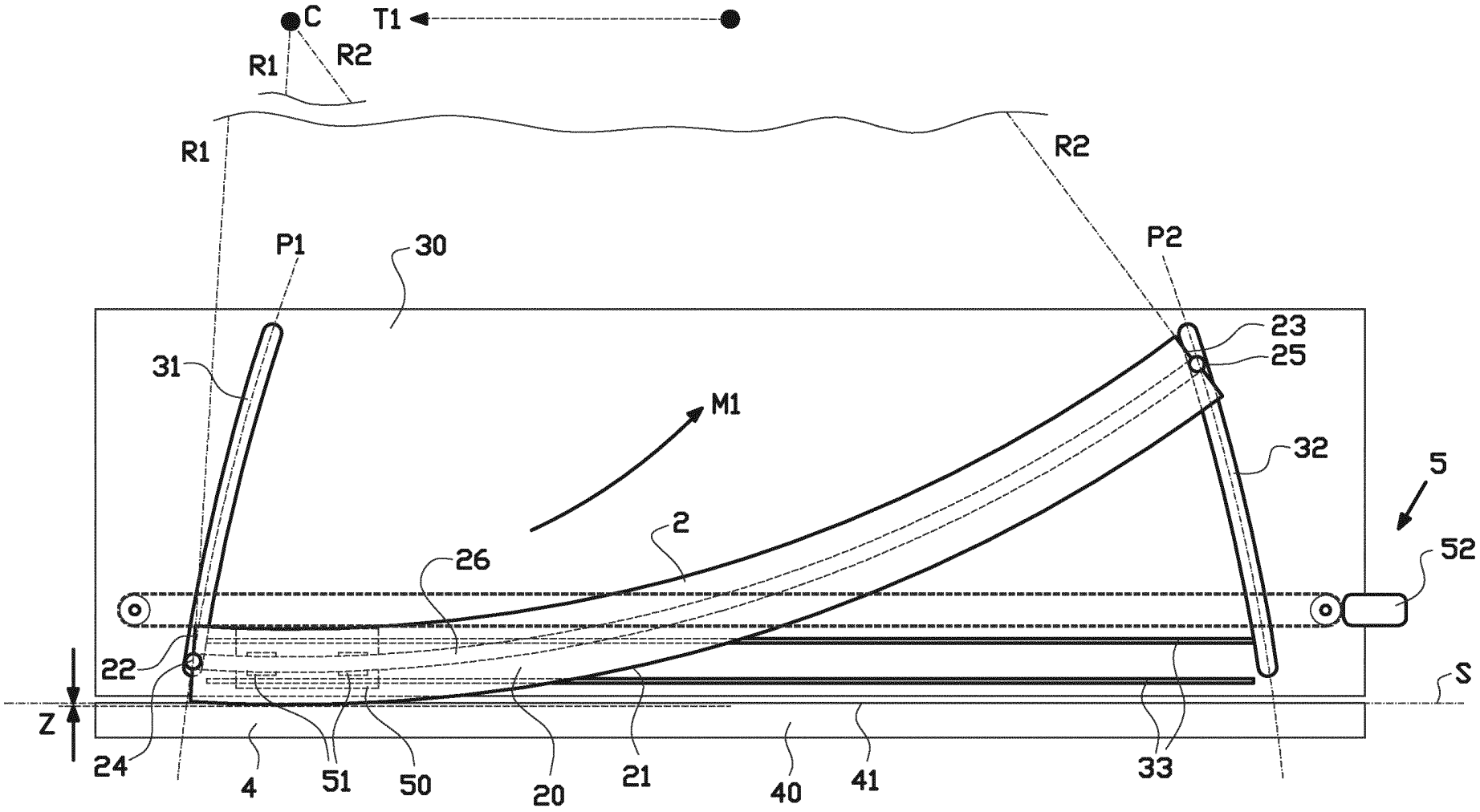
C
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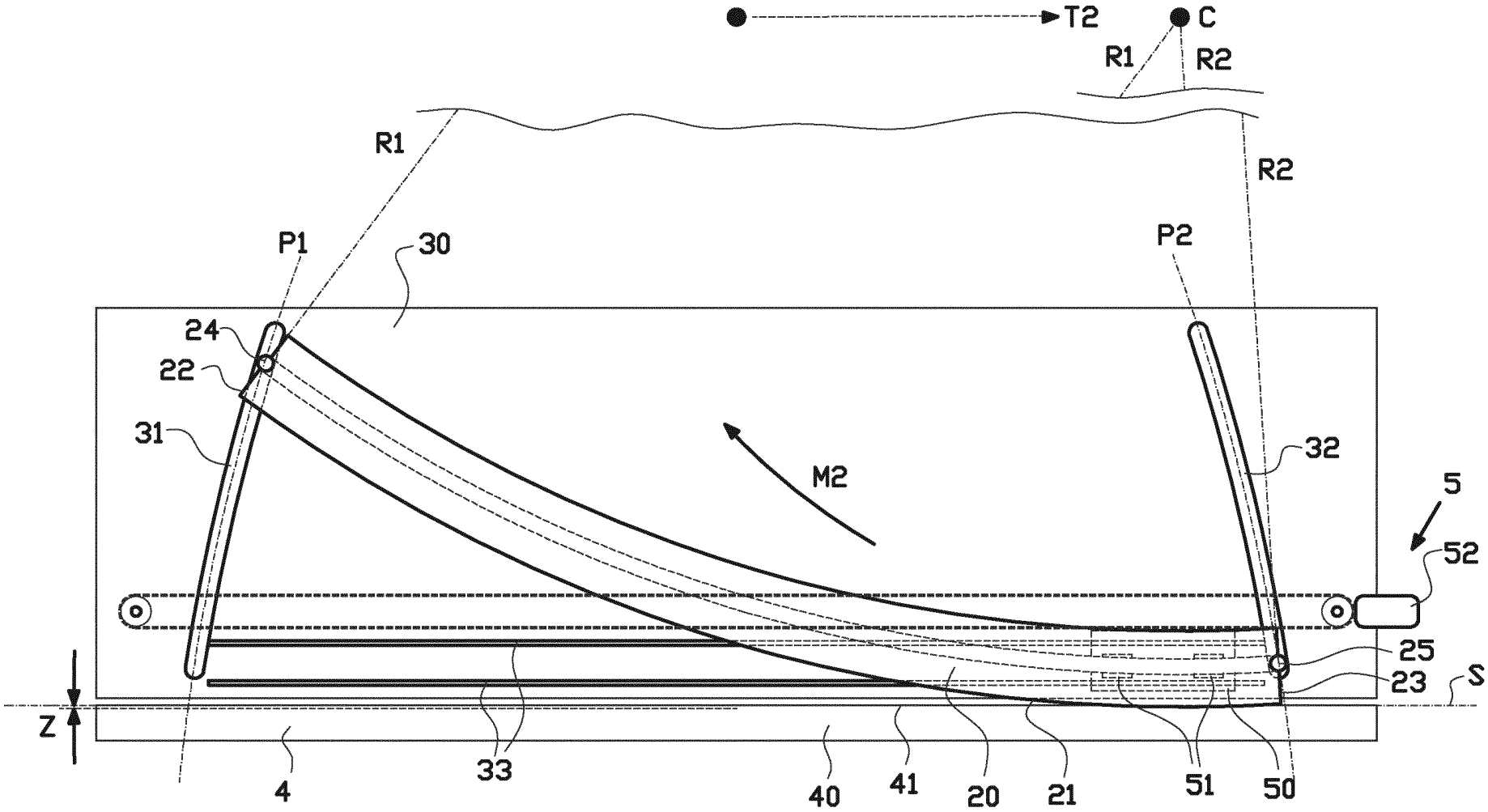
FIG. 3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C
R1
R2
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R2
P1
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P2
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M2
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FIG. 4

A B S T R A C T

The invention relates to a cutting device for cutting tire components, wherein the cutting device comprises an upper cutting member and a lower cutting member, wherein the upper cutting member is arranged to be moved in a cutting plane along the lower cutting member to cut the tire component in cooperation with the lower cutting member along a cutting line, wherein the upper cutting member comprises an upper knife with an upper cutting edge that is convexly arcuate in the cutting plane with respect to the lower cutting member, wherein the upper cutting member is arranged to be moved with the arcuate upper cutting edge thereof along the lower cutting member in a rocking motion in the cutting plane, wherein the arcuate upper cutting edge has a radius and a rotation center for the rocking motion at the origin of said radius, wherein the rotation center is located outside the upper cutting member.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	NLP15470A
Nederlands aanvraag nr. **2013158**	Indieningsdatum **09-07-2014**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **VMI Holland B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **11-10-2014**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN62933**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

B26D3/00 **B26D1/45** **B26D7/00** **B26D1/00**

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**B26D** **B23D**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2013158

A. CLASSIFICATIE VAN HET ONDERWERP
INV. B26D3/00 B26D1/45 B26D7/00
ADD. B26D1/00

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
B26D B23D

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	WO 2011/162600 A1 (VMI HOLLAND BV [NL]; JANSZEN CORNELIS WOUTERES [NL]; TEN WOLDE WIEBE H) 29 december 2011 (2011-12-29) * bladzijde 1, regel 3 - bladzijde 4, regel 25 * * bladzijde 8, regel 14 - bladzijde 11, regel 34; figuren 1,2 * -----	1-25

☐ Verdere documenten worden vermeld in het vervolg van vak C.

☒ Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
19 maart 2015	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Maier, Michael

Formulier PCT/ISA/201 (tweede blad) (Januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2013158

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
WO 2011162600 A1	29-12-2011	CN 102958655 A	06-03-2013
		EP 2585259 A1	01-05-2013
		JP 2013529555 A	22-07-2013
		KR 20130083435 A	22-07-2013
		NL 2004966 C	28-12-2011
		RU 2013102998 A	27-07-2014
		TW 201208840 A	01-03-2012
		US 2013205958 A1	15-08-2013
		WO 2011162600 A1	29-12-2011

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN62933	09.07.2014		NL2013158

International Patent Classification (IPC)
INV. B26D3/00 B26D1/45 B26D7/00 ADD. B26D1/00

Applicant
VMI Holland B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Maier, Michael

Application number

WRITTEN OPINION

NL2013158

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	1-25
	No:	Claims	
Inventive step	Yes:	Claims	1-25
	No:	Claims	
Industrial applicability	Yes:	Claims	1-25
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VII Certain defects in the application

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 WO 2011/162600 A1

2 The document D1 is regarded as being the prior art closest to the subject-matter of claim 1, and shows (bladzijde 1, regel 3 - bladzijde 4, regel 25; bladzijde 8, regel 14 - bladzijde 11, regel 34; figuren 1,2) a cutting device for cutting tire components, from which the subject-matter of claim 1 differs in the features down from line 7 ("waarbij het vovensnijdeel en bovenmes omvat...").

The subject-matter of claim 1 is therefore novel.

3 The problem to be solved by the present invention may therefore be regarded as to provide a cutting device for cutting tire components having an improved cutting geometry an driving mechanism.

4 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step, as there is no teaching available in the prior art,which renders the subject-matter of claim 1 obvious in terms of suggesting a modification of the closest prior art such to fall within the terms of claim 1.

5 Dependent claims 2 to 24 comprise all the features of claim 1 and therefore also meet the requirements of novelty and inventive step.

6 Method claim 25 makes use of the apparatus according to the preceding claims and therefore meet the requirements of novelty and inventive step.

Re Item VII

Certain defects in the application

1 The features of claims 1 to 25 are not provided with reference signs placed in parentheses.

2 Independent claim 1 is not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.

3 The relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.