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(54) METHOD AND APPARATUS FOR WORKING BAND MATERIAL

VERFAHREN UND VORRICHTUNG ZUM BEARBEITEN VON BANDMATERIAL

PROCÉDÉ ET APPAREIL POUR TRAVAILLER UN MATÉRIAU EN BANDE

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Description

Background of the invention

[0001] The invention relates to a method and an apparatus for working band material, in particular for cutting side portions of a band made of flexible material.

[0002] Specifically, but not exclusively, the invention can be usefully used for cutting band material, intended for forming elements for electric energy accumulating devices such as, for example, lithium ion batteries, capacitors, supercapacitors and similar devices, in such a manner as to obtain a profile shaped with a series of protrusions and recesses according to a desired geometry.

[0003] Subsequent cutting is known, according to a preset step, along at least one side of a band made of flexible material unwound from a reel.

[0004] The band cut laterally is then cut transversely to obtain single shaped sheets that constitute the elements for the electric energy accumulating device. In general, for such elements very precise working is required, of the order of a few hundredths of a millimetre.

[0005] In order to obtain the requested precision, the band to be cut is kept stationary with respect to the cutting means, at least during the active cutting step.

[0006] On the other hand, in order to have high productivity, it is desirable to supply the band continuously at a uniform speed. For this purpose, using cutting means with reciprocating movement in a direction that is longitudinal to the supplying line of the band to be cut is known, so as to make the relative speed substantially nil with respect to the band at the cutting instant.

[0007] Such solutions are, nevertheless, complex to implement and do not ensure effective and reliable operation. In particular, it is not possible to reach a high operating speed, mainly because the cutting means, owing to the relatively high mass thereof, cannot be moved in a longitudinal direction with excessive speed, obviously forcing the band advancing speed to be limited.

[0008] The working method in question is of the type according to the preamble of the first claim, in which it is not necessary for the operating means that act on the band in the work station to be provided with reciprocating motion in a longitudinal direction to the supplying line of the band being worked, as, in the portion of the band path where there is the work station, the band is guided by a kinematic system in such a manner as to perform a series of operating cycles, each of which comprises a stationary step, in which the band is stationary and the tools of the work station can work effectively, and a recovery step, in which the band advances quickly through the work station to ensure continuity of motion over the rest of the path.

[0009] Such a method is already known, for example from patent publications DE 1227304 and GB 06369. US 2010/0252603 A1 discloses a method as in the preamble of claim 1.

[0010] Known methods of this type, nevertheless, have

some limits and drawbacks.

[0011] In the first place, the use of constructionally complex and expensive apparatuses is provided.

[0012] Secondly, it is desirable to increase the period of time in which, at each work cycle, the band remains stationary in the work station.

[0013] It is further desirable to improve the regularity of the advancement of the band and further ensure high working precision having, at the same time, considerable productivity.

Summary of the invention

[0014] One object of the invention is to overcome the aforesaid limits and drawbacks of the prior art, devising a method for working a band in a work station that works intermittently, in which the band is conveyed forwards regularly and continuously, but having at least one band portion that, at each work cycle, stops temporarily in the work station.

[0015] One advantage is to permit a long stationary time of the band in the work station.

[0016] One advantage is to permit very regular advancement of the band, minimising perturbations due to traversing of the zones in which, in order to permit dwelling of part of the band, a cycle of accumulating and recovering the band occurs.

[0017] One advantage is to provide a very versatile working method that is able to vary the operating parameters simply and rapidly, in particular without the need to make structural modifications to the working system.

[0018] One advantage is to ensure the desired working precision, having, at the same time, high productivity.

[0019] One advantage lies in the possibility of varying simply and rapidly, the advancement step of the band at each work cycle.

[0020] One advantage is to perform reliable and precise lateral cutting of band material to make components intended for forming electric energy accumulating devices.

[0021] One object of the invention is to provide an apparatus for working a band that is dragged forwards regularly and continuously and has a portion that, at each work cycle, stops temporarily in a work station that operates intermittently.

[0022] One advantage is to devise a constructionally cheap and simple apparatus.

[0023] Such objects and advantages and still others are all reached by the apparatus and the method according to one or more of the claims set out below.

[0024] In one example, a band, which is supplied along a path that passes through a work station that operates intermittently, is coupled with rotating tensioning means that perform a series of work cycles in which each cycle comprises a band stop step in which there is an increase of the band path upstream of the work station and a decrease of the path downstream, in order to maintain the band stationary in the work station, and a band recovery

step, in which there is a decrease of the path upstream and an increase of the path downstream, to pass the band portion accumulated during the stop step quickly through the work station in order to ensure continuity in the motion of the band in the rest of the path.

[0025] The rotating tensioning means is rotated at a variable rotating speed with a periodical undulating course. The band can be unwound continuously from a reel, for example at constant speed. The rotating tensioning means can form two loops of variable size in the path of the band, one upstream and the other downstream of the work station, in which the rotation of the tensioning means produces a variation in size of the loops.

[0026] In particular, a dragging device is provided that advances a band continuously, for example at constant speed, along a preset path that passes through a cutting station, whilst two eccentric rollers coupled with the band, one upstream and the other downstream of the station, induce a band portion to perform cyclically a stop in the cutting station in which, during the stop, a lateral band portion is cut to form a shaped contour that is suitable for making, for example, elements of an electric energy accumulating device, in particular a lithium battery, a capacitor, a supercapacitor, etc. The band is wound on the two eccentric rollers that are rotated at variable rotating speed with a periodical undulating course.

Brief description of the drawings

[0027] The invention can be understood and implemented better with reference to the attached drawings that illustrate an embodiment thereof by way of non limiting example.

Figure 1 is a vertical raised side view of an example of the apparatus in question.

Figure 2 shows an enlarged detail of the apparatus in figure 1.

Figure 3 is a diagram of the rotation speeds of the eccentric rollers depending on the rotation angle in two configurations that differ from one another by the advancement step of the band at each cycle.

Figure 4 is a diagram of the rotation speeds of the eccentric rollers depending on the rotation angle in two configurations that differ from one another by the band dwell period in the work station.

Figure 5 is a diagram of the advancement speed of the band in the work station as a function of the rotation angle of the eccentric rollers in three configurations that differ from one another by the band dwell period in the work station.

Detailed description

[0028] With reference to figure 1, with 1 an apparatus has been indicated overall for working band material 2, in particular for cutting the band 2. The apparatus 1 can serve for cutting a side portion of the band 2, in such a

manner as to make a shaped edge (with protrusion/s alternating with recess/es) of an element for an electric energy accumulating device, for example a lithium battery, a capacitor, a supercapacitor, etc.

[0029] The apparatus 1 comprises supplying means for continuously supplying (at constant speed) the band 2 along a supply path. The supplying means may comprise, as in the specific case, a dragging device having two grippers 3 and 4 that are able to grasp the band 2 and arranged one after the other along the supplying path of the band 2. Each gripper 3 and 4 is provided with an alternating movement with an outward stroke and a return stroke. The dragging device is controlled according to a preset work cycle, such that whilst a gripper (3 or 4) performs the outward stroke in the closing position by grasping the band to drag the band forwards, the other gripper (4 or 3) performs the return stroke in the opening position, in which it leaves the band free, to then restart in the subsequent cycle with the outward stroke in which it retakes the band, which will be freed by the other gripper, which at the same time performs the return stroke. The coordinated work of the two movable grippers forwards and backwards enables the band 2 to regularly and continuously advance (at constant speed).

[0030] The apparatus 1 comprises a work station 5 (in particular, a cutting station for cutting the side edge of the band) provided with working means, for example two cutting half moulds 6 and 7 that are movable alternatively between an open position and a closed position to cut intermittently at least one side portion of the band 2.

[0031] The apparatus 1 comprises first tensioning means arranged for continuously varying the length of the path of the band 2 in a first portion upstream of the work station 5. The first tensioning means determines an accumulating step of the band 2 in which the band will have nil speed in the work station 5. The apparatus 1 further comprises second tensioning means arranged for continuously varying the length of the path of the band 2 in a second portion downstream of the work station 5 to compensate for the variation in the length of the band 2 in the first portion upstream of the station. This compensation will enable the overall length of the path of the band 2 to be maintained constant in a portion of path comprised between the first tensioning means and the second tensioning means.

[0032] The first and second tensioning means substantially enables a path portion to be obtained in which the band 2 has intermittent motion (with a cycle having a dwell step at a substantially nil speed in which the band accumulates and a fast advancement step in which the accumulated band is recovered), whereas in the rest of the path the band 2 has continuous motion (for example at constant speed).

[0033] It is observed that the work station 5 is in the part of the path with intermittent motion of the band 2, whereas the dragging device (grippers 3 and 4) is in the rest of the path with continuous motion of the band 2. In particular, the dragging device is arranged downstream

of the second tensioning means.

[0034] The first tensioning means, just like the second tensioning means, is configured so as to form a loop of the band 2 of variable size. In the specific case the first tensioning means comprises a first cylindrical body, for example a first roller 8, carried, in an eccentric position, from a first rotating support (first crank disc 9) rotated around a first rotation axis that is transverse to the advancement direction F of the band 2. Similarly, the second tensioning means will comprise a second cylindrical body, for example a second roller 10, carried, in an eccentric position, from a second rotating support (second crank disc 11) rotated (in the same direction as the first support) around a second rotation axis that is transverse to the advancing direction F of the band 2 (parallel to the first rotation axis).

[0035] The band 2 will be coupled with the two eccentric rollers 8 and 10. Each eccentric roller 8 and 10 is carried freely rotatable on the respective support.

[0036] The path of the band may comprise, as in this case, at least a first reel 12, at the start of the path, from which the band will unwind. Along the unwinding path various tensioning rollers 13 (with a stationary rotation axis) may be arranged that are coupled with the band 2. There will be a central (horizontal) path portion in which the band 2 traverses the work station 5. At the end of the path the band 2 may, for example, be rewound on at least a second reel 14.

[0037] The apparatus 1 comprises means for varying cyclically the rotation speed of the first tensioning means of the band and of the second tensioning means of the band so as to have, at each work cycle, at least one speed increase and at least one speed decrease step. Such means for varying may comprise, as in the specific case, a programmable electronic control unit and programme instructions that are implementable on the control unit to control the driving means that rotate the first and the second tensioning means of the band. In particular, each crank disc will be rotated by a respective motor (not shown) controlled by the control unit according to a preset computer programme.

[0038] In operation, the apparatus 1 will actuate a band material working method with the following steps.

[0039] The band 2 will be supplied along the preset path thereof. The dragging device (movable grippers 3 and 4) will advance the band 2 with continuous motion (for example at constant speed), at least in the continuous motion part of the path not comprised between the two eccentric rollers 8 and 10. In particular, the band will be unwound from the reel 12 (and possibly rewound on the reel 14) with a continuous and regular motion.

[0040] The work station (cutting station) will operate intermittently on the band 2, with a series of work cycles, in the intermittent motion part of the path comprised between the two eccentric rollers 8 and 10.

[0041] The first tensioning means of the band, in particular the first crank disc 9 that eccentrically carries the first roller 8, will be rotated to vary cyclically the length of

the first path portion upstream of the work station 5, so as to stop the band 2 temporarily in the work station at each work cycle. At the same time, the second band tensioning means, in particular the second crank disc 11 that eccentrically carries the second roller 10, will be rotated to vary cyclically the length of the second path portion downstream of the work station, in such a manner as to compensate for the variation in length of the first path portion and thus permit continuous motion of the band in the path portion downstream of the second roller 10.

[0042] The rotation speed of the first tensioning means and/or of the second tensioners will be controlled in such a manner as to give rise to a cyclical pattern of the speeds that has, at each work cycle, at least one speed increase step and at least one speed decrease step. In particular the rotation speed of the first tensioning means and/or of the second tensioners can have a periodic undulating pattern. In this manner, it is possible to obtain a relatively long band stationary period, with a regular band motion that is almost devoid of perturbation, ensuring great precision in working (lateral cutting) of the band.

[0043] The rotation speed of the first tensioning means (first crank disc 9) is varied, in particular, to determine, at each revolution (of the first crank disc 9), a stationary period, in which the band 2 remains stationary in the work station 5, and a moving period, in which the band advances in the work station. The stationary period can be obtained at an angular movement of the first tensioning means that is greater than or the same as at least 30 degrees of rotation.

[0044] The maximum absolute value of the accelerations of the first tensioning means in the moving period may be the same as or less than the maximum absolute value of the accelerations of the first tensioning means in the stationary period. By doing so, the regularity of the movement of the band can be improved, decreasing the risk of perturbation of the motion.

[0045] In particular, the rotation speed of the first band tensioning means may be varied to determine, at each revolution, a single maximum speed and a single minimum speed. Further, also the rotation speed of the second tensioning means may be varied to determine, at each revolution, a single maximum speed and a single minimum speed.

[0046] It is possible to control the apparatus such that, instant by instant, whilst the rotation speed of the first band tensioning means increases, the rotation speed of the second band tensioning means decreases. It is further possible to control the apparatus in such a manner that, instant by instant, whilst the speed of the first band tensioning means decreases, the speed of the second band tensioning means increases.

[0047] The absolute values of the accelerations of the first band tensioning means may be, instant by instant, substantially the same as the absolute values of the accelerations of the second band tensioning means.

[0048] The diagram in figure 3 shows the rotation

speed of first crank disc 9 that carries the first eccentric roller 8 (upstream of the work station) and of the second crank disc 11 that carries the second eccentric roller 10 (downstream of the work station), which are measured as a percentage ratio of a reference rotation speed that is assumed to be the same as 100%. The values of the rotation speeds are evaluated according to the angular position adopted by the rollers 8 and 10 around the respective rotation axis from a reference position that is assumed to be equal to 0 (zero) degrees. In figure 3 two different configurations are shown relating to two different advancement steps of the band in the work station at each work cycle. Varying the advancement step enables the apparatus to be adjusted according to the band length that has to be worked (cut) at each cycle in the work station. In particular, this enables products to be made (elements for electric energy accumulating devices) of different sizes. In the specific example the two different configurations relate to two different sizes of product with lengths, respectively of 131 mm and of 134 mm.

[0049] The curves "131mmEccMonte" and "131mmEccValle" are the rotation speeds, respectively, of the first and of the second crank disc 9 and 11 in the format 131 mm, whilst the curves "134mmEccMonte" and "134mmEccValle" are the rotation speeds, respectively, of the first and of the second crank disc 9 and 11 in the size 134 mm.

[0050] In both the configurations of figure 3 (131 mm and 134 mm), the dwell period in which the band has nil speed in the work station occurs in the angular movement portion of the eccentric rollers comprised between 0 and 120 degrees. In the remaining portion between 120 and 360 degrees the band advances in the work station at an average recovery speed that will be greater than the average speed (which in particular will be constant) with which the dragging device advances the band.

[0051] In figure 4 the curves are shown of the values assumed by the rotation speeds of the two eccentric rollers 8 and 10 in two different configurations in which the dwell period is varied during which the band has a nil speed in the work station. In a first configuration the dwell period occurs in the angular movement portion of the eccentric rollers 8 and 10 comprised between 0 and 120 degrees (in figure 4 the case of the 131 mm size is shown, for which the curves of the two rollers in this configuration correspond to the analogous ones shown in figure 3). In the other configuration (still with the 131 mm size) the band dwell period occurs in the portion comprised between 0 and 90 degrees.

[0052] The curves "120°EccMonte" and "120°EccValle" are the rotation speeds, respectively, of the first and of the second crank disc 9 and 11 when the band dwell period occurs in the portion comprised between 0 and 120 degrees, whilst the curves "90°EccMonte" and "90°EccValle" are the rotation speeds respectively, of the first and of the second crank disc 9 and 11 when the band dwell period occurs in the portion comprised between 0 and 90 degrees.

[0053] In figure 5 three curves are shown relating to the advancement speeds of the band in the work station, at each work cycle, according to the angle of rotation of the eccentric rollers 8 and 10 (in the case of the 131 mm size), in three different configurations in which the band dwell period occurs in the rotation portions comprised respectively between 0 and 40 degrees, between 0 and 90 degrees and between 0 and 120 degrees (these are respectively the curves "Sosta40°", "Sosta90°" and "Sosta120°"). The speed pattern of the speed of the (continuously) moving band in the path outside the portion comprised between the eccentric rollers 8 and 10 ("VeloProdotto") is also shown, a pattern that, in the specific case, is shown by a horizontal straight line that indicates a constant speed. In the graph in figure 5 the values of the advancement speeds are expressed as a percentage of the (constant) value of the band speed in the path outside the tensioning means.

[0054] It has been seen that the rotating tensioning means is arranged for forming two loops of variable size in the path of the band, one loop upstream and one loop downstream of the work station. Rotating the tensioning means produces a variation in the size of the loops in a coordinated manner so that the length of the path portion comprised between the tensioning means remains substantially constant, so as to avoid disturbances in the motion of the band outside the rotating tensioning means. It has been further seen that some of the variables of the system that is disclosed here can be modified without changing the mechanical parts of the system, but through relatively simpler interventions that modify the instructions of the computer programme that controls the rotating means of the tensioning means.

Claims

1. Method comprising the steps of:

- supplying a band (2) along a path;
- arranging a work station (5) in the path that works intermittently on the band (2) with a series of work cycles;
- rotating first tensioning means (8, 9) of the band (2) for varying cyclically the length of a first path portion upstream of the work station (5) stopping the band (2) temporarily in the work station at each work cycle;
- rotating second tensioning means (10, 11) of the band (2) for varying cyclically the length of a second path portion downstream of the work station (5) compensating the length variation of the first path portion;
- cyclically varying the rotation speed of the first tensioning means and of the second tensioning means such as to have, at each work cycle, at least one speed increase and at least one speed decrease

, wherein the rotation speed of the first tensioning means (8, 9) is varied to determine, at each revolution of the first tensioning means, a stationary part of the work cycle, in which the band (2) is stationary in the work station, and a movable part of the work cycle, in which the band (2) is movable in the work station, **characterised in that:**

the maximum absolute value of the accelerations of the first tensioning means (8, 9) in the movable part of the work cycle is less than the maximum absolute value of the accelerations of the first tensioning means (8, 9) in the stationary part of the work cycle.

2. Method according to any preceding claim, wherein the rotation speed of the first tensioning means (8, 9) is varied to determine, at each revolution, a single maximum speed point at null acceleration and a single minimum speed point at null acceleration.

3. Method according to any preceding claim, wherein the rotation speed of the second tensioning means (10, 11) is varied to determine, at each revolution, a single maximum speed point at null acceleration and a single minimum speed point at null acceleration.

4. Method according to any preceding claim, wherein, instant for instant, whilst the rotation speed of the first tensioning means (8, 9) increases, the rotation speed of the second tensioning means (10, 11) decreases, and/or wherein, whilst the rotation speed of the first tensioning means (8, 9) decreases, the rotation speed of the second tensioning means (10, 11) increases.

5. Method according to any preceding claim, wherein the absolute values of the accelerations of the first tensioning means are, instant for instant, substantially the same as the absolute values of the accelerations of the second tensioning means.

6. Apparatus, in particular for actuating the method of any preceding claim, comprising:

- a supply path of a band (2);
- a work station (5) arranged in said path for operating intermittently on the band (2) with a series of work cycles;
- first tensioning means (8, 9) of the band that can rotate to vary cyclically the length of said path in a first portion upstream of said work station (5) stopping the band temporarily in said work station at each cycle;
- second tensioning means (10, 11) of the band that can rotate to vary cyclically the length of said path in a second portion downstream of said work station (5) compensating the variation in length in said first portion;
- means for varying cyclically the rotation speed

of said first tensioning means and of said second tensioning means such as to have, at each work cycle, at least one speed increase and at least one speed decrease, wherein the rotation speed of the first tensioning means (8, 9) is varied to determine, at each revolution of the first tensioning means, a stationary part of the work cycle, in which the band (2) is stationary in the work station, and a movable part of the work cycle, in which the band (2) is movable in the work station;

characterised in that the maximum absolute value of the accelerations of the first tensioning means (8, 9) in the movable part of the work cycle is less than the maximum absolute value of the accelerations of the first tensioning means (8, 9) in the stationary part of the work cycle.

7. Apparatus according to claim 6, wherein said means for varying comprises a programmable electronic control unit and programme instructions that are implementable on said control unit for controlling means for rotating said first and second tensioning means.

8. Apparatus according to claim 6 or 7, wherein said first tensioning means comprises a first body (8) to which the band (2) is coupled, said first body being mounted in an eccentric position on a first rotating support (9), and/or wherein said second tensioning means comprises a second body (10) to which the band (2) is coupled, said second body being mounted in an eccentric position on a second rotating support (11).

Patentansprüche

1. Verfahren, das die folgenden Schritte aufweist:

- Zuführen eines Bandes (2) entlang eines Weges;
- Anordnen einer Arbeitsstation (5) in dem Weg, der auf dem Band (2) mit einer Folge von Arbeitszyklen intermittierend arbeitet;
- Drehen von ersten Spannmitteln (8, 9) an dem Band (2), um die Länge eines ersten Wegabschnittes stromaufwärts der Arbeitsstation (5) zyklisch zu verändern, mit temporärem Anhalten des Bandes (2) in der Arbeitsstation bei jedem Arbeitszyklus;
- Drehen von zweiten Spannmitteln (10, 11) an dem Band (2), um die Länge eines zweiten Wegabschnittes stromabwärts der Arbeitsstation (5) zyklisch zu verändern, mit Kompensieren der Längenveränderung des ersten Arbeitsabschnittes;
- zyklisches Variieren der Drehgeschwindigkeit

- des ersten Spannmittels und des zweiten Spannmittels derart, dass bei jedem Arbeitszyklus wenigstens eine Geschwindigkeitsvergrößerung und eine Geschwindigkeitsverringerung erfolgt, wobei die Drehgeschwindigkeit der ersten Spannmittel (8, 9) verändert wird, um bei jeder Umdrehung des ersten Spannmittels einen stationären Teil des Arbeitszyklus zu bestimmen, bei dem das Band (2) auf der Arbeitsstation stationär ist, sowie einen beweglichen Teil des Arbeitszyklus, bei dem das Band (2) in der Arbeitsstation beweglich ist, **dadurch gekennzeichnet, dass** der maximale absolute Wert der Beschleunigungen der ersten Spannmittel (8, 9) in dem beweglichen Teil des Arbeitszyklus geringer als der maximale absolute Wert der Beschleunigungen der ersten Spannmittel (8, 9) in dem stationären Teil des Arbeitszyklus ist.
2. Verfahren nach irgendeinem vorhergehenden Anspruch, bei dem die Drehgeschwindigkeit der ersten Spannmittel (8, 9) verändert wird, um bei jeder Umdrehung einen einzigen maximalen Geschwindigkeitspunkt mit einer Beschleunigung von Null und einen einzigen minimalen Geschwindigkeitspunkt mit einer Beschleunigung von Null zu bestimmen.
3. Verfahren nach irgendeinem vorhergehenden Anspruch, bei dem die Umdrehungsgeschwindigkeit der zweiten Spannmittel (10, 11) verändert wird, um bei jeder Umdrehung einen einzigen maximalen Geschwindigkeitspunkt bei einer Beschleunigung von Null und einen einzigen minimalen Geschwindigkeitspunkt bei einer Beschleunigung von Null zu bestimmen.
4. Verfahren nach irgendeinem vorhergehenden Anspruch, bei dem, während die Drehgeschwindigkeit der ersten Spannmittel (8, 9) zunimmt, die Drehgeschwindigkeit der zweiten Spannmittel (10, 11) sofort abnimmt und/oder bei dem, während die Drehgeschwindigkeit der ersten Spannmittel (8, 9) abnimmt, die Drehgeschwindigkeit der zweiten Spannmittel (10, 11) zunimmt.
5. Verfahren nach irgendeinem vorhergehenden Anspruch, bei dem die absoluten Werte der Beschleunigung der ersten Spannmittel sofort im Wesentlichen dieselben sind, wie die absoluten Werte der Beschleunigungen der zweiten Spannmittel.
6. Vorrichtung, insbesondere zur Durchführung des Verfahrens gemäß irgendeinem vorhergehenden Anspruch, mit:
- einem Versorgungsweg eines Bandes (2);
 - einer Arbeitsstation (5), die in dem Weg ange-

ordnet ist, um intermittierend an dem Band (2) mit einer Folge von Arbeitszyklen zu arbeiten;

- ersten Spannmitteln (8, 9) des Bandes, die sich drehen können, um die Länge des ersten Weges in einem ersten Bereich stromaufwärts der Arbeitsstation (5) zyklisch zu verändern, wobei das Band temporär in der Arbeitsstation bei jedem Zyklus angehalten wird;
- zweiten Spannmitteln (10, 11) des Bandes, die sich drehen können, um die Länge des Weges in einem zweiten Bereich stromabwärts der Arbeitsstation (5) zyklisch variieren zu können, wobei die Längenvariation in dem ersten Bereich kompensiert wird;
- Mitteln zum zyklischen Variieren der Drehgeschwindigkeit der ersten Spannmittel und der zweiten Spannmittel, um so bei jedem Arbeitszyklus wenigstens eine Geschwindigkeitszunahme und wenigstens eine Geschwindigkeitsabnahme zu haben, wobei die Drehgeschwindigkeit der ersten Spannmittel (8, 9) variiert wird, um bei jeder Umdrehung der ersten Spannmittel einen stationären Teil des Arbeitszyklus zu bestimmen, bei dem das Band (2) in der Arbeitsstation stationär ist, und um einen beweglichen Teil des Arbeitszyklus zu bestimmen, bei dem das Band (2) in der Arbeitsstation beweglich ist, **dadurch gekennzeichnet, dass** der maximale absolute Wert der Beschleunigungen der ersten Spannmittel (8, 9) in dem beweglichen Teil des Arbeitszyklus geringer als der maximale absolute Wert der Beschleunigungen der ersten Spannmittel (8, 9) in dem stationären Teil des Arbeitszyklus ist.

7. Vorrichtung nach Anspruch 6, bei dem das Mittel zum Variieren eine programmierbare elektrische Steuereinheit ist und Programmbefehle umfasst, die auf der Steuereinheit implementierbar sind, um Mittel zum Drehen der ersten und der zweiten Spannmittel zu steuern.
8. Vorrichtung nach Anspruch 6 oder 7, bei der das erste Spannmittel einen ersten Körper (8) aufweist, an den das Band (2) gekoppelt ist, wobei der erste Körper in einer exzentrischen Position an einer ersten Drehaufnahme (9) befestigt ist, und/oder wobei das zweite Spannmittel einen zweiten Körper (10) aufweist, an den das Band (2) gekoppelt ist, wobei der zweite Körper in einer exzentrischen Position an einer zweiten Drehaufnahme (11) befestigt ist.

Revendications

1. Procédé comprenant les étapes de:

- fournir une bande (2) le long d'un trajet;

- agencer une station de travail (5) dans le trajet qui fonctionne de manière intermittente sur la bande (2) avec une série de cycles de travail;
 - faire tourner des premiers moyens tendeurs (8, 9) de la bande (2) pour faire varier cycliquement la longueur d'une première portion de trajet en amont de la station de travail (5) arrêtant la bande (2) temporairement dans la station de travail à chaque cycle de travail;
 - faire tourner des seconds moyens tendeurs (10, 11) de la bande (2) pour faire varier cycliquement la longueur d'une seconde portion de trajet en aval de la station de travail (5) compensant la variation de longueur de la première portion de trajet;
 - faire varier cycliquement la vitesse de rotation des premiers moyens tendeurs et des seconds moyens tendeurs de manière à avoir, à chaque cycle de travail, au moins une augmentation de vitesse et au moins une diminution de vitesse, dans lequel la vitesse de rotation des premiers moyens tendeurs (8, 9) est changée pour déterminer, à chaque révolution des premiers moyens tendeurs, une partie fixe du cycle de travail, dans laquelle la bande (2) est fixe dans la station de travail, et une partie mobile du cycle de travail, dans laquelle la bande (2) est mobile dans la station de travail, **caractérisé en ce que** la valeur absolue maximale des accélérations des premiers tendeurs (8, 9) dans la partie mobile du cycle de travail est inférieure à la valeur absolue maximale des accélérations des premiers moyens tendeurs (8, 9) dans la partie fixe du cycle de travail.
2. Procédé selon l'une quelconque des revendications précédentes, dans lequel la vitesse de rotation des premiers moyens tendeurs (8, 9) est changée pour déterminer, à chaque révolution, un seul point de vitesse maximale à accélération nulle et un seul point de vitesse minimale à accélération nulle.
3. Procédé selon l'une quelconque des revendications précédentes, dans lequel la vitesse de rotation des seconds moyens tendeurs (10, 11) est changée pour déterminer, à chaque révolution, un seul point de vitesse maximale à accélération nulle et un seul point de vitesse minimale à accélération nulle.
4. Procédé selon l'une quelconque des revendications précédentes, dans lequel, instant par instant, lorsque la vitesse de rotation des premiers moyens tendeurs (8, 9) augmente, la vitesse de rotation des seconds moyens tendeurs (10, 11) diminue, et/ou dans lequel, lorsque la vitesse de rotation des premiers moyens tendeurs (8, 9) diminue, la vitesse de rotation des seconds moyens tendeurs (10, 11) augmente.
5. Procédé selon l'une quelconque des revendications précédentes, dans lequel les valeurs absolues des accélérations des premiers moyens tendeurs sont, instant par instant, sensiblement identiques aux valeurs absolues des accélérations des seconds moyens tendeurs.
6. Appareil, en particulier pour mettre en oeuvre le procédé selon l'une quelconque des revendications précédentes, comprenant:
- un trajet d'approvisionnement d'une bande (2) ;
 - une station de travail (5) agencée dans ledit trajet pour fonctionner de manière intermittente sur la bande (2) avec une série de cycles de travail;
 - des premiers moyens tendeurs (8, 9) de la bande qui peuvent tourner pour faire varier cycliquement la longueur dudit trajet dans une première portion en amont de ladite station de travail (5) arrêtant la bande temporairement dans ladite station de travail à chaque cycle;
 - des seconds moyens tendeurs (10, 11) de la bande qui peuvent tourner pour faire varier cycliquement la longueur dudit trajet dans une seconde portion en aval de ladite station de travail (5) compensant la variation de longueur dans ladite première portion;
 - des moyens pour faire varier cycliquement la vitesse de rotation desdits premiers moyens tendeurs et desdits seconds moyens tendeurs de manière à avoir, à chaque cycle de travail, au moins une augmentation de vitesse et au moins une diminution de vitesse, dans lequel la vitesse de rotation des premiers moyens tendeurs (8, 9) est changée pour déterminer, à chaque révolution des premiers moyens tendeurs, une partie fixe du cycle de travail, dans laquelle la bande (2) est fixe dans la station de travail, et une partie mobile du cycle de travail, dans laquelle la bande (2) est mobile dans la station de travail; **caractérisé en ce que** la valeur absolue maximale des accélérations des premiers moyens tendeurs (8, 9) dans la partie mobile du cycle de travail est inférieure à la valeur absolue maximale des accélérations des premiers moyens tendeurs (8, 9) dans la partie fixe du cycle de travail.
7. Appareil selon la revendication 6, dans lequel lesdits moyens de variation comprennent une unité de commande électronique programmable et des instructions de programme qui peuvent être mises en oeuvre sur ladite unité de commande pour commander des moyens pour faire tourner lesdits premiers et seconds moyens tendeurs.

8. Appareil selon la revendication 6 ou 7, dans lequel lesdits premiers moyens tendeurs comprennent un premier corps (8) auquel la bande (2) est couplée, ledit premier corps étant monté dans une position excentrique sur un premier support rotatif (9), et/ou dans lequel lesdits seconds moyens tendeurs comprennent un second corps (10) auquel la bande (2) est couplée, ledit second corps étant monté dans une position excentrique sur un second support rotatif (11).

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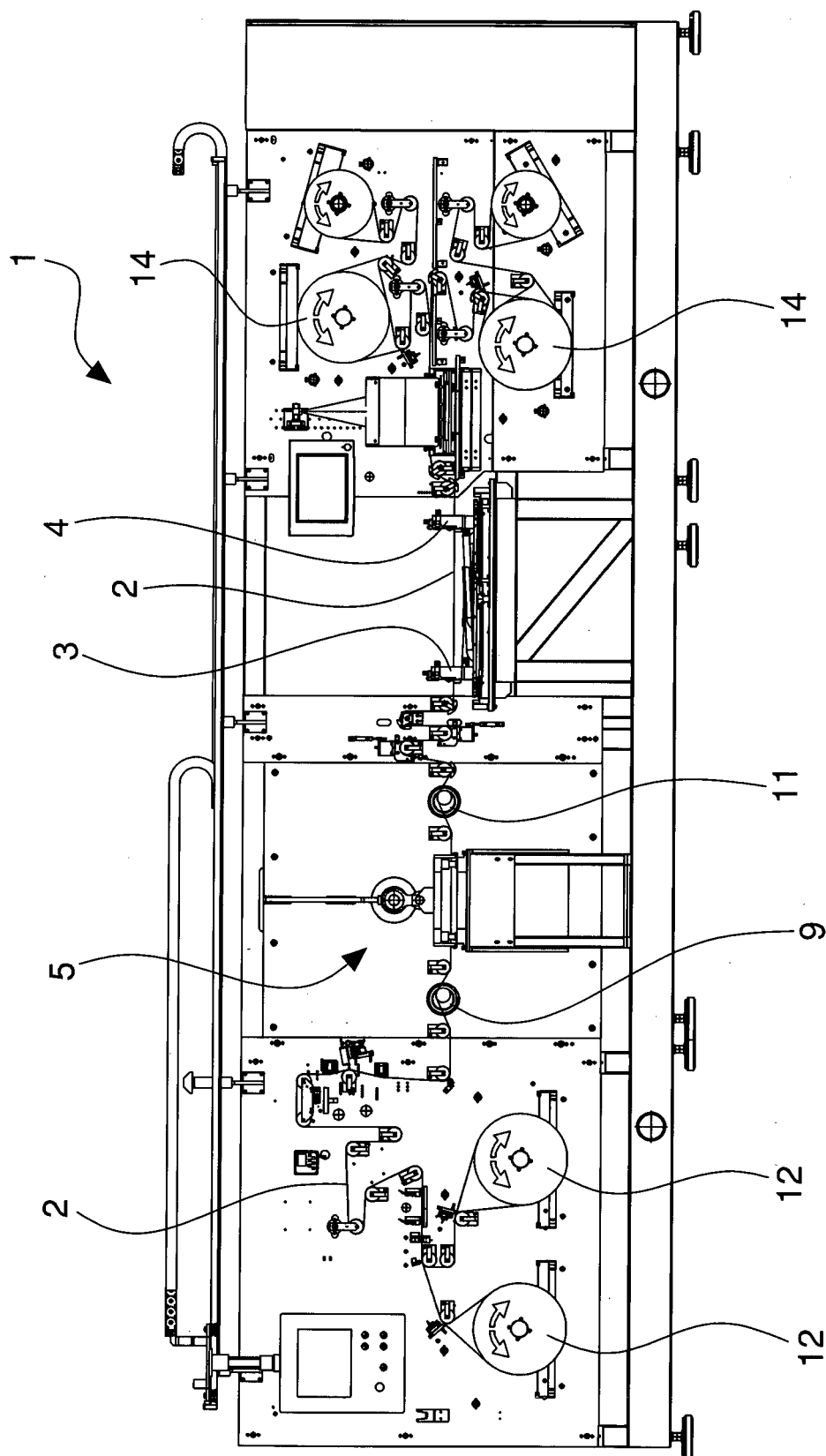


Fig. 1

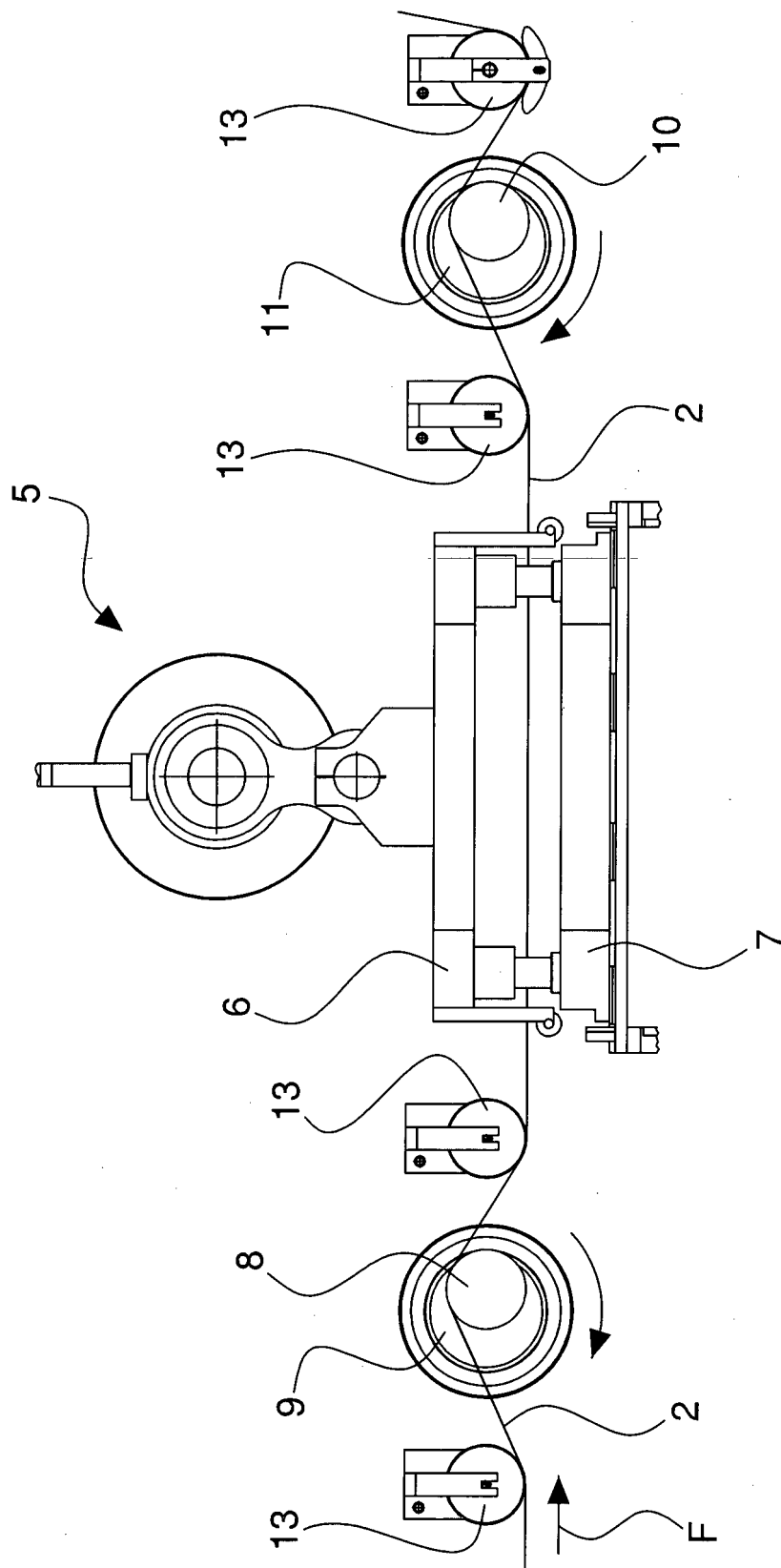


Fig. 2

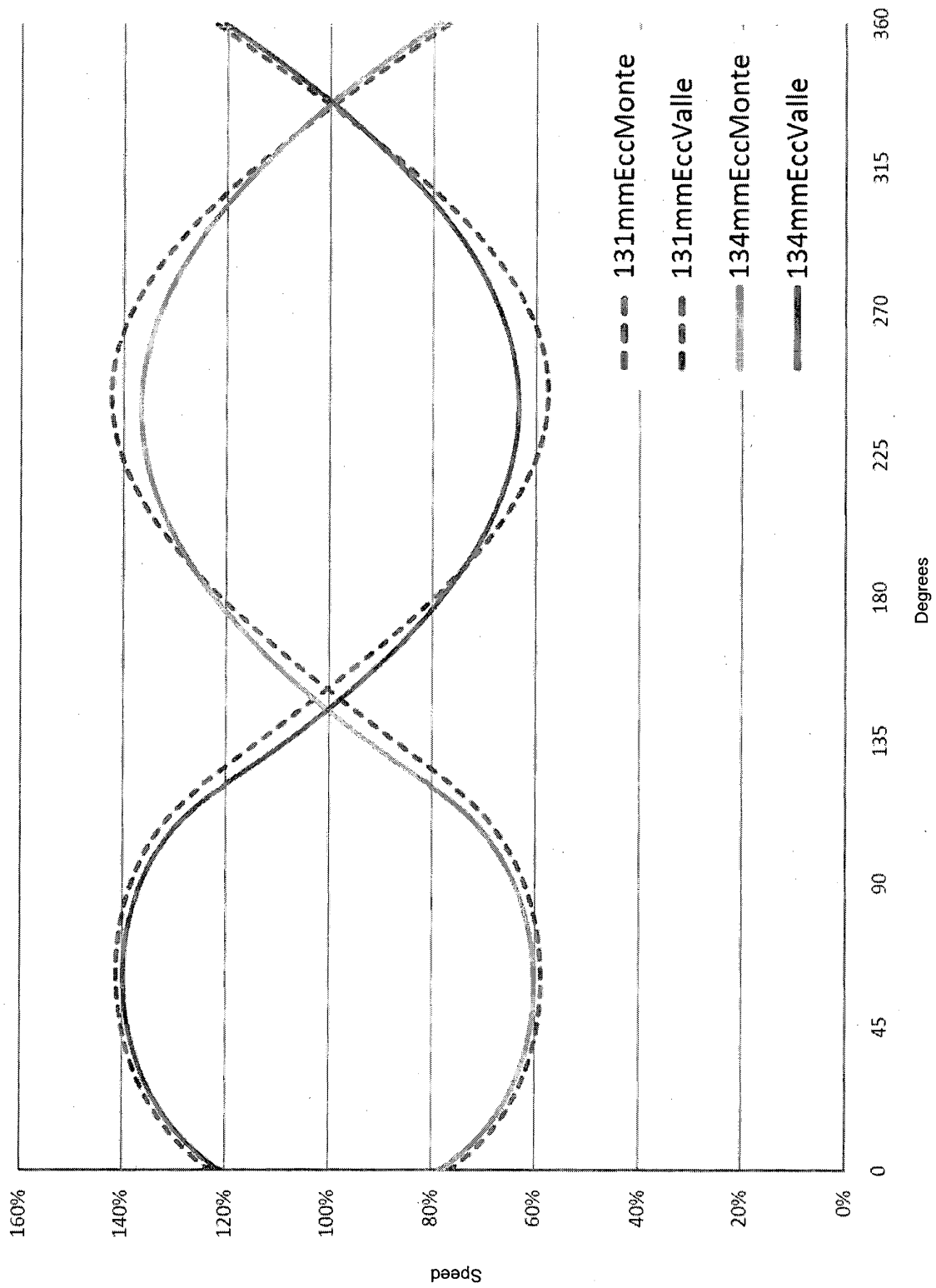


Fig. 3

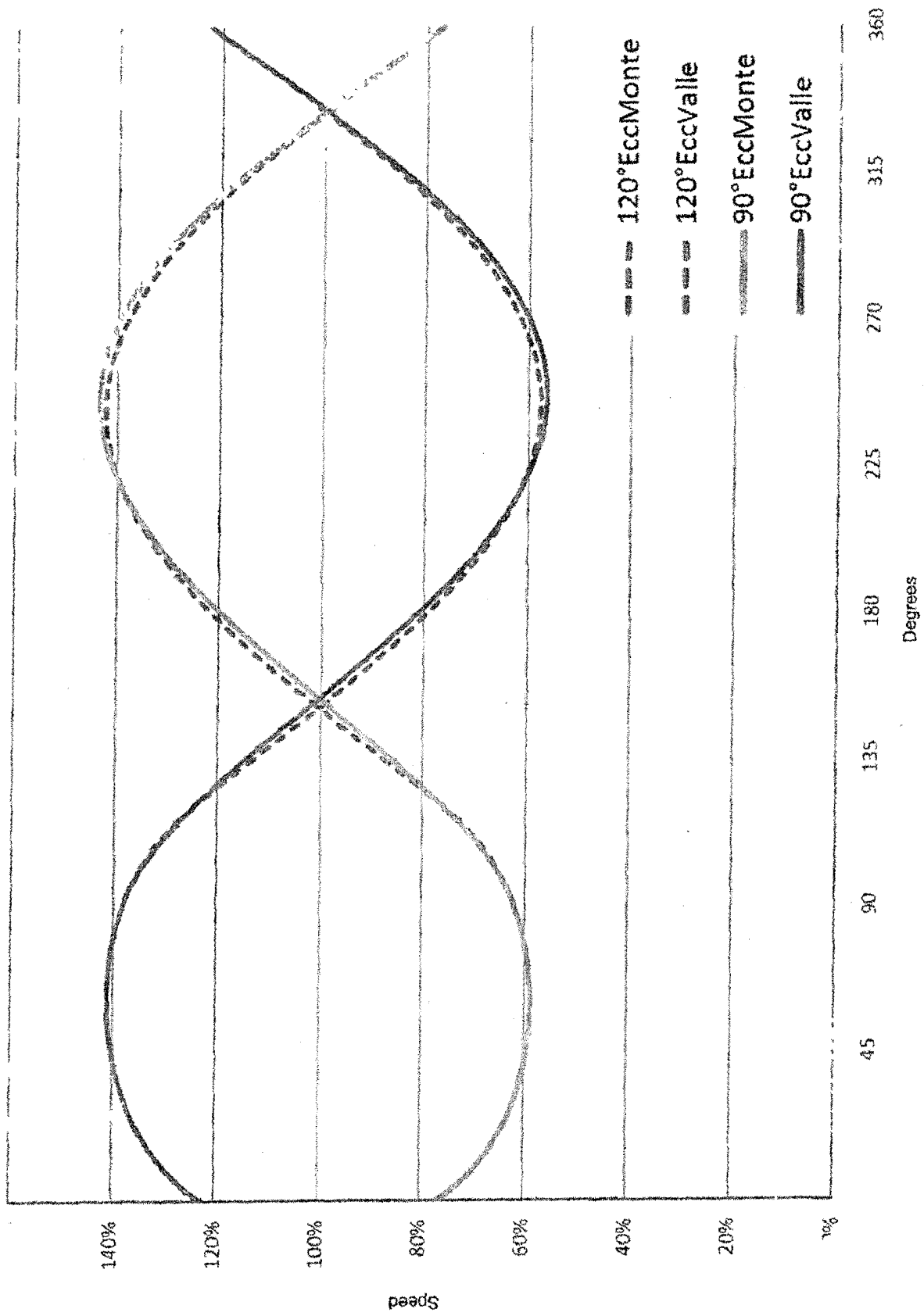


Fig. 4

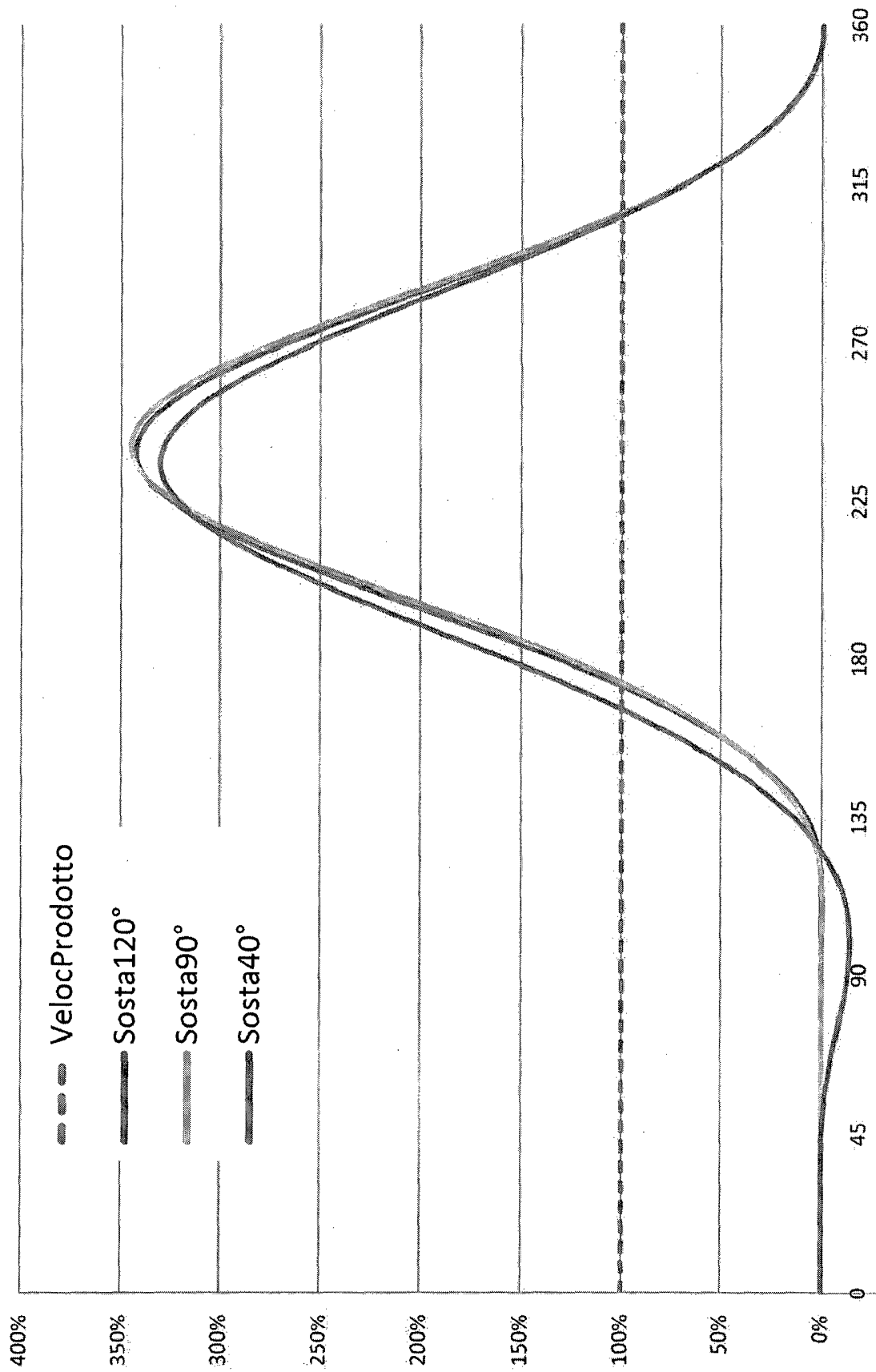


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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