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(54) **FOOTWEAR CONVEYOR**

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a conveyor device for shoes (i.e. footwear), provided with sole and/or insole, in an apparatus for thermal treatment, and also to an apparatus for thermal treatment of shoes provided with said conveyor device.

PRIOR ART

[0002] The production of footwear, such as shoes, boots, slippers, etc., in the modern footwear industry, entails a certain number of processing steps wherein the various parts of which the shoe is constituted are not only progressively assembled with one another, but also subjected to heat or chemical treatments of different kinds, according to the finished product to be obtained.

[0003] It is pointed out that here and hereunder the term "shoe" is intended not only as the finished shoe ready for packaging and sale, but also as any semi-finished product which is to become a shoe. For example, the term "shoe" is also intended as the semi-finished product constituted of the upper (i.e. shoeupper) with only the insole, or of the upper with the insole and the arch support, without the sole.

[0004] Among the various thermal treatments to which shoes are subjected during assembly, such as treatments to reactivate or deactivate adhesives, to stretch the materials, or thermal stabilization treatments, due to the effects obtained on the finished product, the treatment to stretch the leather is particularly critical; this consists in treating the upper, optionally assembled only with the insole, at high temperature, either dry or with steam.

[0005] In this case, the shoe, not yet finished, is positioned on a conveyor device which conveys it into a specific oven inside which, in predefined conditions of relative humidity and temperature, (up to 200°C) the shoe dwells for sufficient time to perform said operation to stretch the leather.

[0006] More specifically, the unfinished shoe, mounted on a relative last and usually constituted only of the upper to which the insole has been bonded (e.g. glued), is conveyed by the conveyor device, into and out of the chamber of the oven, preferably so that during thermal treatment the upper does not come into contact with any bodies other than the insole, such as the walls of the oven or of the conveyor device itself, so that stretching of the leather of the upper is not endangered.

[0007] Moreover, in the thermal treatment above, the temperature, any delivery of steam and the dwell time of the shoes in the chamber of the oven are parameters that are carefully regulated, as any steam present, the heat transmitted by convection and irradiation inside the chamber of the oven and, above all, the heat transferred by conduction from the conveyor device to the shoe, can easily cause reactivation of the adhesive used to assemble the insole with the upper, with consequent undue detachment of the two parts.

[0008] Another critical thermal treatment to which shoes can be subjected consists in the placing said shoes in a chamber in which conditions of low temperature are maintained (known as "refrigeration chamber"). This treatment allows complete deactivation of the adhesives used to assemble the soles and also stabilizes the entire shoe.

[0009] In particular, in this thermal treatment at low temperature, performed almost at the end of operations to assemble the shoes when the sole has been provided, the shoes are placed on a supporting element which, kinematically connected to motor means, conveys the shoes into the refrigeration chamber, allows them to dwell there for a predetermined period of time, and then conveys the shoes out of the refrigeration chamber.

[0010] Also during this treatment, it is preferable to prevent the upper from coming into contact with bodies other than those of which the shoe is constituted, to prevent any impacts from causing damage to the leather of the upper or deformities in the whole shoe.

[0011] In both the aforesaid processes, and also in other thermal treatment processes for shoes in which the upper, or other portions of the finished or unfinished shoe, must be prevented from coming into contact with foreign bodies which can cause damage to said upper or to the whole shoe, prior art provides for the use of a conveyer device comprising a metal or plastic (e.g. PET) conveyor belt, optionally provided with one or more elements to support and constrain the shoes.

[0012] In an extremely simplified but very popular embodiment of the conveyor device, this is constituted of a common conveyor belt, usually made of metal, on the links of which the lower portion of the shoe, that is the insole, the arch support or the sole, of according to the degree of assembly reached, is simply placed. At this point, the conveyor belt, unavoidably at a low linear speed, performs the operations to convey the shoes into the apparatus for thermal treatment, to allow them to dwell there for the required time and to convey them out of the apparatus.

[0013] The British patent GB 1.472.647 by the applicant SALIENT ENGINEERING teaches the use of a common conveyor belt to convey shoes into an apparatus for the thermal treatment thereof. Similarly, the European patent application EP-A-0.512.127 (SHÖN & CIE) refers to the use of a conveyor belt to convey shoes into an apparatus for thermal treatment.

[0014] Mere placing of the shoe on the conveyor belt, usually made of metal, does not obviously provide sufficient guarantee that the shoe will not overturn during movement on said belt or will not sway (i.e. swing) thereby allowing the upper, or other outer portions of the shoe, to come into contact with damaging foreign bodies.

[0015] Moreover, the low operating speed of the conveyor belt, required to minimize movements of the shoes on said belt, makes these thermal treatment operations

extremely slow.

[0016] Finally, the heat transferred by conduction from the conveyor device to the shoe (or vice versa), which causes damaging temperature gradients inside said shoe, makes it necessary to reduce the dwell times of the shoe in the thermal treatment system, resulting in a less efficacious thermal treatment.

[0017] In other embodiments of conveyor belts for conveying shoes, finished or unfinished, into apparatus for thermal treatment, shaped moving supporting elements can also be provided which, made integral or obtained in once piece with said conveyor belt, allow the shoes to be constrained mechanically, preferably by interlocking (thanks to matching shapes).

[0018] For example, United States patent US 4.553.341, by the applicant HANSON, refers to the use of a conveyor belt provided with shaped seats inside which shoes can be inserted to undergo treatment in an apparatus for thermal treatment. In fact, in the conveyor belt, opportunely made of Terylene (PET), the aforesaid seats are constituted of openings of suitable dimension and shape, into which an upper can be only partially inserted, so that it is constrained on the conveyor belt.

[0019] Similarly, the French patent FR 2.587.885, by the applicant HUBER, describes a conveyor system, suitable to translate shoes inside an oven for reactivating adhesives, provided with a plurality of carriages equipped with stops and guides to constrain said shoes by means of interlocking.

[0020] In both the above solutions, although preventing the shoes from swaying significantly and overturning while being conveyed, it is however practically impossible to prevent outer surfaces of the upper, or other outer portions of the shoe, from coming into contact with the surfaces of foreign bodies, including the stops and guides of the holding means, thereby determining slight, or even noteworthy, imperfections in the finished shoe.

[0021] Moreover, in both of the above solutions the means to hold the shoe on the conveyor devices, belt or carriages, come into contact not only with portions of the shoe that are not visible to the user, such as the lower surface of the sole or of the insole, but also constrain portions of the outer surfaces of the shoe, for example of the upper, which in the finished shoe are instead visible to the user.

[0022] It is therefore an object of the present invention to provide a conveyor device for shoes, unfinished or finished, in an apparatus for thermal treatment which does not have the drawbacks of prior art.

[0023] It is thus an object of the present invention to provide a conveyor device wherein, during any thermal treatment, the possibility of outer parts of the shoe, and in particular of the upper, coming into contact with foreign bodies which can cause damage to said shoe, is reduced to a minimum or prevented.

[0024] Another object of the present invention is to provide a conveyor device which, substantially preventing damage to the shoes during thermal treatment to which they are subjected, allows a high conveying speed and therefore high production rates to be obtained in the apparatus for thermal treatment in which the conveyor is used.

[0025] A further object of the present invention is to provide an apparatus for thermal treatment of shoes, unfinished or finished, equipped with a conveyor device that minimizes any damage to the shoe and simultaneously has a high conveying speed.

SUMMARY OF THE INVENTION

[0026] These and other objects are obtained by the conveyor device for shoes as claimed in independent claim one and in the subsequent dependent claims and by the apparatus for thermal treatment of shoes as claimed in the claim fourteen and in the subsequent dependent claims.

[0027] The device for conveying shoes, finished or unfinished, in an apparatus for thermal treatment, according to the present invention, comprises at least one movable transport element for one or more of the aforesaid shoes, which movable transport element in turn is provided with at least one thermally insulating support to support at least a portion of at least one of the shoes, and with means to hold said finished or unfinished shoes engaged stably with said thermally insulating support. Said means are also shaped to engage with said at least one portion of the shoe resting on the thermally insulating support, without interfering with other outer portions, and in particular visible to the final user, of the shoe not resting on the thermally insulating support.

[0028] Preferably, as already mentioned, the portion with which the finished or unfinished shoe rests on the insulating support is constituted of the sole, the arch support or the insole, or of the bottom portion of the shoe.

[0029] Due to the fact that only one portion, preferably the bottom portion, of the shoe is held engaged with a support made of thermally insulating material, and also to the fact that the holding means act exclusively on this portion of the shoe, i.e. preferably on the sole and/or arch support and/or insole, without involving other outer parts of said shoe, the conveyor device of the present invention makes it possible to overcome the aforesaid drawbacks found in prior art conveyor devices.

[0030] Placing the sole, arch support or insole, or another portion of the shoe which is not visible in the finished shoe, on a support made of thermally insulating material, prevents any thermal loads, to which the conveyor device is subjected, from being transferred rapidly to the shoe by conduction, causing thermal shocks in the leather of said shoe. Moreover, constraining (holding) of the sole, arch support or insole, or other portion of the shoe, on said insulating support minimizes the possibilities of the shoe swaying or overturning on the conveyor device, which could cause impacts or undue contact of the outer surfaces of the upper with foreign bodies, during movement of said conveyor device.

[0031] According to a preferred aspect of the present invention, these holding means can advantageously be of the kind with suction, or generating a vacuum, so that, for example, suitable suction nozzles, in fluid connection with a suction device, can come into contact with the portion of the shoe resting on the thermally insulating support, preferably the sole, the arch support or the insole, only for the time required to convey the shoe into the apparatus for thermal treatment, without causing possible deformation to the portion of the shoe resting on the support.

[0032] In other embodiments of the present invention, the means to hold the bottom portion of the shoe can be of the magnetic type, for example, exploiting the presence of the last inside the unfinished shoe. In this case, magnetic or ferromagnetic elements can be inserted in the last of the shoe in correspondence to the sole, arch support or insole, and corresponding ferromagnetic or magnetic elements can be positioned on the insulating support to functionally engage with the elements present in the last.

[0033] In further embodiments of the present invention, the holding means can comprise first mechanical coupling elements temporarily connected to the outer portion of the shoe resting on the insulating support, such as the sole, the arch support or the insole, and second coupling elements, connected to the thermally insulating support, functionally associable with said first coupling elements, such as a system with hooks and corresponding rings.

[0034] According to another aspect of the present invention, the movable transport element is a metal conveyor belt, connected to which is a further belt made of synthetic material, such as silicone, forming said thermally insulating support.

[0035] According to another aspect, the present invention provides an apparatus for thermal treatment of shoes, finished or unfinished, equipped with at least one conveyor device carried out according to the indications above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] Some embodiments of the present invention will now be described, purely by way of a non-limiting example, with reference to the accompanying drawings, wherein:

- Figure 1 is a schematic side view of an apparatus for thermal treatment of shoes, comprising a conveyor device according to a particular aspect of the present invention;
- Figure 2 is a schematic top plan view of the apparatus in Figure 1 ;
- Figure 3 is a sectional front view of a support of a conveyor device according to a preferred aspect of the present invention;
- Figure 4 is a sectional side view of a support of a conveyor device according to another aspect of the present invention;
- Figure 5 is a schematic side view of a conveyor device, provided with oscillating insulating supports, according to a preferred aspect of the present invention;
- Figure 6 is a schematic side view of an apparatus for thermal treatment of shoes according to a further aspect of the present invention; and
- Figure 7 is a schematic side view of another apparatus for thermal treatment of shoes, according to yet another aspect of the present invention.

DETAILED DESCRIPTION OF SOME PREFERRED EMBODIMENTS OF THE INVENTION

[0037] With reference to Figures 1, 2, the apparatus for thermal treatment of shoes 10, according to the present invention, comprises a system 1 wherein specific conditions of temperature and humidity remain substantially constant while the shoe 10 is conveyed through and dwells in a specific chamber with which said system 1 is equipped, and a conveyor device 2 for conveying each shoe 10 into and out of said system 1.

[0038] As already mentioned, the term "shoe" is intended here not only as a finished shoe, provided with a sole, but also as any semi-finished product to become a shoe and, in particular and preferably, provided with an arch support and/or insole and/or sole.

[0039] The conveyor device 2 comprises at least a moving element 5 for conveying shoes 10, preferably although not exclusively constituted of a conveyor belt, on which a plurality of thermally insulating supports 3 are mounted to support the shoes 10 in correspondence to at least a portion thereof.

[0040] The conveyor device 2 also comprises means 4, 6, 7, 8, 9 to stably constrain (hold) the portion of the shoe resting on the support 3, preferably constituted of the arch support, of the insole and/or of the sole of each shoe 10, on the relative support 3, so that the only portion resting thereon, i.e. preferably only the insole, arch support or sole, is engaged with said means 4, 6, 7, 8, 9.

[0041] The use of insulating supports 3 makes it possible to ensure that the shoe 10, finished or unfinished depending on the process, is not subjected to undue thermal shocks caused, for example, by transfer of heat by conduction from the conveyor belt 5, normally made of metal, to said shoe; while said means 4, 6, 7, 8, 9, engaging only with one portion of the shoe 10, chosen for example from those not visible to the user or constituted of the arch support, insole or sole, not only guarantee considerable static stability of the shoe 10 on the conveyor device 2 inside the system 1, but also prevent said means 4, 6, 7, 8, 9 from causing damage to visible outer portions of said shoe 10.

[0042] These means 4, 6, 7, 8, 9 can include, as will be described in greater detail hereunder, suction holding means, magnetic interaction means or even mechanical

holding means, suitable to connect the support 3 solely to the portion of said shoe 10 that rests on said support 3, constituted, for example, of strips of Velcro®, metal hooks and rings temporarily connected to the portion of shoe resting on said support 3, removable bands of silicone, etc..

[0043] In particular, use of the means 4, 6, 7, 8, 9 shaped so as not to interfere with other outer portions of the shoe, such as the outer surfaces (i.e. visible to the user) of the upper, and to stably constrain portions such as the arch support, insole and/or sole of each shoe 10 on the insulating support 3 thereof, prevents stresses from being generated, inside the material forming the upper, due to contact (and therefore to relative constraining reaction and to heat exchange by conduction) between the upper and foreign bodies, during the thermal treatments to which the shoes 10 are subjected.

[0044] In the particular and preferred embodiment of the conveyor device according to the present invention, represented in Figures 1 to 3, the holding means 4, 6, 7, 8, 9 are of the type with suction, or generating a vacuum, and comprise, for each insulating support 3, at least one suction nozzle 4, cup-shaped, positioned inside the relative support 3 to constrain, by means of a suction air flow, the shoe 10 on said support 3. The suction nozzle 4, the inlet section of which is substantially positioned in correspondence to the surface of the support 3 on which the shoe rests, can in fact be in fluid connection, by means of a suitable fluid circuit, with a suction device 9 to produce a flow of incoming air in said suction nozzle 4.

[0045] In the embodiment in Figures 1-3, more specifically, the fluid circuit which connects each nozzle 4 with the suction device 9 comprises a flexible pipe 8 in fluid connection with a sealed chamber or duct 7, moving jointly with the belt 5, which is in turn connected to connection pipes 6 for the suction nozzles 4. The flexible pipe 8 can be connected jointly with the sealed duct 7 and, therefore, due to its extensibility, can move jointly with said duct 7, or engage so that the duct 7 can slide with respect to the pipe 8, while maintaining, through the use of suitable gaskets, the substantial fluid tightness of the connection between duct 7 and pipe 8.

[0046] The suction nozzles 4 can be constituted of suction cups or pads made of silicone material which are arranged inside the insulating supports 3, so that each has its own inlet section, of a greater diameter, in correspondence to the outer surface of the relative insulating support 3, and its own outlet section, with smaller diameter, in fluid connection with said connection pipe 6 (see in particular Figure 3).

[0047] According to this configuration of the suction holding means 4, 6, 7, 8, 9, the flow of air directed towards the suction device 9 is fed through the inlet section of each nozzle 4, penetrates the connection pipe 6 and the sealed duct 7, moving jointly with the belt 5, and then passes through the flexible pipe 8, fixed or extensible, to reach the fan of the suction device 9. This generates, suitably regulating the operating conditions of the device 9, a vacuum in correspondence to the inlet section of each nozzle 4 sufficient to constrain a shoe 10 on said nozzle 4 in correspondence to the sole, arch support or insole thereof, or of another portion chosen by the user.

[0048] Alternatively, in an embodiment not shown, the nozzle 4 can be connected, by a Venturi tube, to a compressor device for producing a flow of pressurized air inside a fluid circuit.

[0049] In particular, the pressurized flow produced by a compressor can be made to pass, in correspondence to each nozzle 4, inside a Venturi tube, the narrow section of which has a branch in fluid connection with the relative nozzle 4. The vacuum which is generated in the narrow section of each Venturi tube, for example positioned in place of the connection pipe 6 of each suction nozzle 4, causes suction of a flow of air in correspondence to the inlet section of said nozzle 4, sufficient to constrain the shoe 10 on the thermally insulating support 3. The thermally insulating support 3 can be constituted of a pad made of insulating material, such as silicone, suitably fastened to the outer surface of the conveyor belt 5, or to the outer surface of any other movable transport element, or can be constituted of a thermally insulating band superimposed on the conveyor belt 5 (or other transport element).

[0050] The thickness of the support 3, if silicone material is used, can vary from 5 to 200 mm, in order to guarantee suitable thermal insulation of the shoe.

[0051] During use of the conveyor device described above, the operator, either manually or with the use of auxiliary mechanical means, places each shoe 10, finished or unfinished, on at least one insulating support 3, so that a suitable portion of the shoe, such as the insole, coincides with the inlet section of at least one suction nozzle 4, and positioning the shoe 10 so that rests only on said support 3. The vacuum generated in correspondence to said inlet section of the nozzle 4 allows the shoe 10 to be constrained stably on said thermally insulating support 3.

[0052] Regulation of the suction power of the device 9, and therefore regulation of the vacuum generated in correspondence to the inlet sections of the nozzles 4, allows finished or unfinished shoes 10, even with considerable differences in shape, dimensions and weight, to be stably constrained, without it being necessary to modify the holding means of the conveyor device 2.

[0053] In this way, heavy swaying or overturning of shoes 10 on the conveyor belt 5 is substantially prevented, and therefore the conveyor belt 5, for conveying shoes 10 into and out of the processing chamber of the thermal treatment system 1, can even move at high speed without this causing damage to the shoes 10 being processed.

[0054] Although means to hold a portion of the shoe 10 resting on the insulating support 3 constituted of the suction or vacuum generating means have been previously described, the present invention is not limited to said means, but also comprises other solutions which

allow shoes 10 to be constrained solely through engagement of said alternative holding means solely with the portion of the shoe 10 resting on the thermally insulating support 3.

[0055] For example, with reference to Figure 4, if the thermal treatment to which the shoe 110 is subjected takes place in an assembly step in which said shoe 110, unfinished, is mounted on a last 111, an alternative embodiment of the conveyor device 105 according to the present invention comprises the use of holding means 112, 113, magnetically operating.

[0056] In this case, the holding means can comprise a permanent magnet 112, or alternatively a ferromagnetic plate, incorporated in the last 111 of the shoe 110, and a corresponding magnet or ferromagnetic plate 113 incorporated in the thermally insulating support 103.

[0057] In particular, the magnetic or ferromagnetic element 112 can be inserted inside the last 111 in correspondence to the bottom portion of said last 111, or the portion which will come into contact with the insole, the sole or the arch support of the shoe 110.

[0058] Magnetic interaction between the element 112 incorporated in the last 111 and the element 113 incorporated in the insulating support 103 causes engagement of these elements with only the portion of the shoe 110 resting on said support 103 and thereby determines stable constraining of the shoe 110 on the support 103, in correspondence to the portion resting thereon.

[0059] Figure 5 shows a further aspect of the present invention wherein a conveyor device 202 to convey shoes 210 into a thermal treatment system (not shown), comprises a plurality of thermally insulating supports 203 which are mounted on the movable transport element, for example a conveyor belt 205, so that these supports 203 have at least one degree of freedom with respect to said movable transport element, or conveyor belt 205.

[0060] More specifically, in the embodiment shown in Figure 5, the thermally insulating supports 203, constituted for example of a silicone pad, are fastened to corresponding blades 211, which are in turn constrained on the conveyor belt 205 rotating with respect to an axis of rotation, which can be (for ease of implementation) orthogonal to the direction of advancement of said belt 205.

[0061] According to the present invention, the device 202 also comprises means, now shown, but of the type described in the previous description, to hold bottom portions of the shoe 210 in stable engagement with the aforesaid thermally insulating supports 203, wherein said means are shaped to engage with at least a portion of each shoe 210 resting on the supports 203, without interfering with other outer portions of the shoe 210 not resting on the supports 203.

[0062] In the case in which the supports 203 are shaped so that two supports 203 are placed adjacent in the direction of advancement of the conveyor belt 205 for the purpose of respectively constraining the front bottom portion and the rear bottom portion of a shoe 210 (see again Figure 5), in the conveyor device 202 described herein at least two adjacent supports 203 can be constrained on the conveyor belt 205 so that each of them can rotate about an axis substantially orthogonal to the direction along which the shoe 210 extends, or along which it is placed on the two adjacent supports 203, and said axes of rotation of the two supports 203 can be positioned in a reciprocally parallel way.

[0063] In this way, it is possible to adapt the surface of the insulating supports 203 to the different shapes of the bottom portion of each shoe 210, 210', 210", without it being necessary to modify parts of said conveyor device 202. For example, it is possible, without distinction, to place, constrain and convey, on the device 202, shoes 210' which require subsequent attaching of a heel of considerable height and shoes 210" without a heel, or with a small heel in the finished shoe, without it being necessary to change the insulating supports 203, but by merely modifying the inclination thereof with respect to the supporting surface of the belt 205.

[0064] Figure 6 shows an apparatus for thermal treatment of shoes, comprising a particular conveyor device 302 for conveying shoes 310, 310', 310", 310"', according to a preferred aspect of the present invention, into and out of a thermal treatment system 301, for example of the type indicated above with reference to Figures 1 and 2.

[0065] The conveyor device 302, similarly to the conveyor devices 2, 102, 202 described above, comprises a plurality of first thermally insulating supports 303, 303', 303" and 303"', mounted on a movable transport element, for example constituted of a conveyor belt 305, and also a plurality of second supports 314, 314', 314", 314"', preferably also thermally insulating and also mounted on the conveyor belt 305.

[0066] Each second support 314, 314', 314", 314"' is in particular associated with a respective first support 303, 303', 303", 303"', so as to form a pair of supports 303, 314; 303', 314'; 303", 314", 303"', 314"' for each single shoe 310, 310', 310", 310"', or part thereof, to be subjected to thermal treatment in the system 301. Each pair of supports 303, 314; 303', 314'; 303", 314", 303"', 314"' is also shaped so that each first support 303, 303', 303", 303"' engages with a limited region of the shoe 310, 310', 310", 310"' and simultaneously each second support 314, 314', 314", 314"' engages with a different limited region of the same shoe 310, 310', 310", 310"', or part thereof, to jointly support said relative shoe 310, 310', 310", 310"' on the transport element 305.

[0067] For example, in the device shown in Figure 6 each pair of supports 303, 314; 303', 314'; 303", 314", 303"', 314"' is shaped to support the upper of a shoe, so that each first support 303, 303', 303", 303"' engages with the toe region of the bottom portion of the relative upper of the shoe 310, 310', 310" e 310"', and each second support 314, 314', 314", 314"' engages with the heel region of said bottom portion of the relative upper of the shoe 310, 310', 310" and 310"'.

[0068] In the embodiment of the device according to

the present invention shown in Figure 6, the first thermally insulating supports 303, 303', 303" and 303"' are preferably mounted integral with the conveyor belt 305 and comprise, similarly to the description above with reference to the previous figures, means, for example constituted of suction nozzles connected to a pump to generate a flow of suction air, to hold with stable engagement the relative bottom portions of the respective shoes 310, 310', 310" e 310"'. Said second supports 314, 314', 314" and 314"' are instead mounted rotatingly on the conveyor belt 305 and can be devoid of means to hold the relative bottom portions of the shoes 310, 310', 310", 310"'. In particular, the second supports 314, 314', 314" and 314"' can be pivoted to the conveyor belt 305 along axes substantially orthogonal to the direction of advancement of said conveyor belt 305.

[0069] The second supports 314, 314', 314", 314"' can also be equipped with means to stably regulate inclination, for example manually, with respect to the relative first support 303, 303', 303" or 303"', and therefore with respect to the conveyor belt 305, to allow them to be adapted precisely to the shape of the upper. In the embodiment in Figure 6, for example, controllable inclination of the second supports 314, 314', 314", 314"' allows the pairs of supports 303, 314; 303', 314'; 303" , 314", 303"' , 314"' to be adapted for uppers with a more or less arched configuration, depending on whether these are models of shoes 310, 310', 310", 310"' with high heels, low heels or substantially without heels.

[0070] The particular conveyor device shown in Figure 6 also advantageously comprises auxiliary supports 315, 315' suitable tohold in a correct position, inside the thermal treatment system 301, shoes 310, 310" with an upper extending to a considerable height, such as the uppers of boots.

[0071] More specifically, each of these auxiliary supports 315, 315' comprises, in the embodiment described herein, an elastic clip with divaricated arms to engage inside the uppermost part of said upper, that is, the opposite part with respect to the portion of said upper that rests on the supports, a slider suitable to be connected slidingly inside a guide 316, parallel superiorly with the conveyor belt 305, and a connector, preferably elastic and constituted for example of a helical spring, which joins the slider to the clip with divaricated arms.

[0072] By way of example, said slider of the auxiliary supports 315, 315' can be constituted of a wheel which can engage and disengage, manually or automatically, inside said guide 316, in this case suitably shaped - e.g. "H-shaped" - to connect said wheel, although leaving it free to roll. The clip with divaricated arms can also have, at least at the end of its arms, thermally insulated areas, suitable to engage with the relative upper of the shoe 310, 310".

[0073] Engagement of the clip with divaricated arms inside the top portion of the upper allows said upper to be held to said clip, so that, due to engagement of the relative slider inside the guide 316, the top portion of the upper is positioned correctly, i.e. well unfold (or stretched) inside the thermal treatment system 301, during conveying thereof.

[0074] It must be pointed out that the auxiliary supports 315, 315', provided to constrain, for example, boot uppers well unfold inside the thermal treatment system 301, also engage with parts of the shoe 310, 310"' not visible to the final user, to prevent causing possible damaged, or aesthetically unappealing, areas in the outer leather of said shoe 310. 310"'.

[0075] Figure 7 shows a further apparatus for thermal treatment of shoes 410, 410', 410", or parts thereof, comprising a thermal treatment system 401 for shoes, for example of the type previously described, and a conveyor device 402, according to another aspect of the present invention, provided to allow conveying of the shoes 410, 410', 410" into and out of said system 401 to be regulated.

[0076] Similarly to the conveyor device 302 described with reference to Figure 6, the device 402 comprises a conveyor belt 405, advantageously made of thermally insulating synthetic material, a plurality of thermally insulating supports 403, 403', 403" for at least a portion of the shoes 410, 410', 410" to be subjected to processing, and also one or more auxiliary supports 415, 415' suitable to hold shoes 410, 410" with an upper extending to a considerable height (such as boots) in the correct position inside the thermal treatment system 401.

[0077] The auxiliary supports 415, 415' of the device shown in Figure 7 are identical to those 315, 315' shown in Figure 6 and therefore the reader is referred to the above description of the auxiliary supports 315, 315' in Figure 6.

[0078] In the particular conveyor device in Figure 7, said thermally insulating supports 403, 403', 403" are shaped to define a surface to support and hold shoes 410, 410', 410", through juxtaposing/opposing complementary parts, and in particular are shaped to constrain shoes 410, 410', 410", to be subjected to thermal treatment, in the correct position, through engagement with suitable bottom regions of said shoes 410, 410', 410".

[0079] More specifically, the supports 403, 403', 403" shown in Figure 7 are shaped in an arc of circumference, extending to 180° in the embodiment described here, and have dimensions and surface characteristics which allow stable constraining of the bottom regions, in this case corresponding to the heel, of the uppers of shoes 410, 410', 410" being processed. Friction between the bottom region of the upper 410, 410', 410" engaged with the relative support 403, 403', 403", and the surface of said arch-shaped supports 403, 403', 403", and friction between the surface of the conveyor belt 405, made of synthetic material, and the bottom region of the upper 410, 410', 410" not engaged with the relative arch-shaped support 403, 403', 403", determines stable constraining of the shoes 410, 410', 410" to the conveyor device 402.

[0080] These arch-shaped supports 403, 403', 403", constituted for example of an arched metal frame cov-

ered with a suitable thermally insulating material, preferably plastic, can also be spaced from one another, on the conveyor belt 405, so that the space existing between two consecutive supports 403, 403' allows a shoe 410, or portion thereof, to be inserted and stably constrained in this space between said two consecutive supports 403, 403'.

[0081] The supports 403, 403', 403" can preferably be connected to the conveyor belt 405 removably, so that they can be easily replaced or variably positioned on said belt 405, and thereby be adapted to the various shapes of shoes being processed.

[0082] In other embodiments of the conveyor device of the present invention, not shown, it is possible to use static suction cups, that is, not in fluid connection with a suction device (or with a compressor connected to a Venturi tube), or also other mechanical means, such as hooks and rings, or strips of Velcro®, temporarily fixed to the surface of the shoe resting on the thermally insulating support.

[0083] The conveyor device of the present invention is particularly suitable for use in apparatus for thermal treatment of shoes, inside which the shoes, which have almost reached a nearly final stage of assembly, are to be subjected to processes to stretch the leather (or other material forming the upper) and/or to deactivate the adhesives used in assembly.

[0084] The use of the conveyor device according to the present invention is particularly advantageous in stretching ovens, wherein controlled delivery of heat and steam take place simultaneously, and in refrigeration chambers for deactivation of adhesives, wherein shoes are subjected to a low temperature. In fact, thanks to the increased conveying speed of shoes which the conveyor device is able to guarantee due to the holding means described above, and the possibility of increasing the dwell time of shoes in the thermal treatment system by thermally insulating the shoes from the conveyor device, guaranteed by the thermally insulating support, a considerable increase in the production rate of said apparatus for thermal treatment can be obtained.

[0085] The efficacy of the holding means, which do not interfere with outer portions, i.e. those visible to the final user, of the shoe, also make it possible to obtain a high production quality, due to minimizing damage to the shoes during said thermal treatments.

Claims

1. Conveyor device (2) for shoes (10; 110) in an apparatus (1) for thermal treatment, the conveyor device comprising at least one movable transport element (5) for one or more of said shoes, **characterized in that** said movable transport element comprises at least one thermally insulating support (3) on which one portion of at least one of said shoes rests, and means (4, 6, 7, 8, 9; 111, 112, 113) to hold said shoe in stable engagement with said thermally insulating support, said means being shaped to engage with said at least one portion of at least one of said shoes resting on said thermally insulating support, without interfering with other outer portions of the shoe not resting on said thermally insulating support.

2. Device as claimed in claim 1, wherein said at least one portion of at least one of said shoes resting on said thermally insulating support is chosen from sole, arch support or insole.

3. Device as claimed in claim 1 or 2, **characterized in that** said means to hold said shoe in stable engagement are of the type with suction and/or generating a vacuum.

4. Device as claimed in claim 3, wherein said suction and/or vacuum generating means comprise a air suction device (9) associated (8) with a chamber or sealed duct (7), said chamber, or sealed duct, being in fluid connection with one or more suction nozzles (4).

5. Device as claimed in claim 3, wherein said suction and/or vacuum generating means comprise a device to generate a flow of pressurized air and a Venturi device to generate a vacuum in correspondence to said sole or said arch support and/or said insole.

6. Device as claimed in claim 1 or 2, **characterized in that** said means to hold said shoe in stable engagement comprise one or more suction pads (4) fastened to said thermally insulating support.

7. Device as claimed in claim 1 or 2, **characterized in that** said means to hold said shoe in stable engagement comprise first mechanical coupling means temporarily coupled to said at least one portion of at least one of said shoes and second removable coupling means connected to said thermally insulating support.

8. Device as claimed in claim 1 or 2, wherein said shoes (110) are mounted on a corresponding last (111), **characterized in that** said means to hold said shoe in stable engagement comprise said last having first magnetic or ferromagnetic means (112) cooperating with corresponding ferromagnetic or magnetic means (113) associated with said thermally insulating support.

9. Device as claimed any one of the previous claims, **characterized in that** said movable transport element is constituted of a conveyor belt (5).

10. Device as claimed in claim 9, **characterized in that** said conveyor belt comprises a belt made of a metal

material.

11. Device as claimed in claim 9 or 10, wherein said thermally insulating support comprises at least one belt made of plastic material constrained on the outer side of said conveyor belt.

12. Device as claimed in claim 9, **characterized in that** said conveyor belt is made of insulating material and forms said thermally insulating support.

13. Device as claimed in any one of the previous claims, **characterized in that** said thermally insulating support is made of silicone.

14. Device as claimed in any one of the previous claims, **characterized in that** said at least one thermally insulating support is constrained to said movable transport element so that it has at least one degree of freedom with respect to said movable transport element.

15. Device as claimed in claim 14, wherein said at least one thermally insulating support is constrained to said movable transport element rotatingly about an axis of rotation.

16. Device as claimed in claim 15, wherein said axis of rotation of said at least one thermally insulating support is substantially orthogonal to the direction of advancement of said movable transport element.

17. Device as claimed in claim 15 or 16, comprising at least two thermally insulating supports adjacent to each other, said two thermally insulating supports being provided to respectively constrain the front portion and the rear portion of said shoe, and being connected to said movable transport element so that each of them can rotate about an axis of rotation, the axes of rotation of said two adjacent supports being reciprocally parallel.

18. Device as claimed in claim 17, wherein said axes of rotation of the adjacent thermally insulating supports are substantially orthogonal to the direction of extension of said shoe.

19. Device as claimed in any one of the previous claims, **characterized in that** it comprises one or more auxiliary supports (315, 315', 316) to constrain at least one portion of at least one of said shoes, said one or more auxiliary supports not interfering with outer portions of the shoe.

20. Device as claimed in claim 19, **characterized in that** said one or more auxiliary supports engage with said at least one portion of one of said shoes, on the opposite part with respect to said portion of the same shoe resting on said thermally insulating support.

21. Device as claimed in claim 19 or 20, **characterized in that** said one or more auxiliary supports are thermally insulating, or the parts thereof which engage with said at least one of said shoes are thermally insulating.

22. Apparatus (1) for thermal treatment of shoes, **characterized in that** it comprises a conveyor device (2) for said shoes (10; 110) in said apparatus, as claimed in any one of the previous claims.

23. Apparatus as claimed in claim 22, **characterized in that** it comprises an oven to stretch the leather.

24. Apparatus as claimed in claim 23, wherein said oven comprises means for blowing of steam into said oven.

25. Apparatus as claimed in any one of claims 22 to 24, **characterized in that** it comprises a refrigeration system for the deactivation of adhesives.

Patentansprüche

1. Fördereinrichtung (2) für Schuhe (10, 110) in einem Apparat (1) zur Wärmebehandlung, wobei die Fördereinrichtung zumindest ein bewegliches Transportelement (5) für einen Schuh oder für mehrere Schuhe umfasst, **dadurch gekennzeichnet, dass** das bewegliche Transportelement zumindest einen wärmedämmenden Träger (3) aufweist, auf dem ein Teilbereich von zumindest einem der Schuhe ruht, und Mittel (4, 6, 7, 8, 9, 111, 112, 113), um den Schuh in einer stabilen Anordnung mit dem wärmedämmenden Träger zu halten, wobei diese Mittel so geformt sind, dass sie mit dem zumindest einen Teilbereich von zumindest einem der Schuhe, die auf dem wärmedämmenden Träger ruhen, so in Verbindung stehen, ohne störend auf andere äußere Teile des Schuhs einzuwirken, die nicht auf dem wärmedämmenden Träger ruhen.

2. Die Einrichtung gemäß Anspruch 1, wobei der zumindest eine Teilbereich von zumindest einem der Schuhe, die auf dem wärmedämmenden Träger ruhen ausgewählt ist aus Sohle, Innengelenkstütze oder Innensohle.

3. Die Einrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Mittel, um den Schuh in einer stabilen Anordnung mit dem wärmedämmenden Träger zu halten, ein Ansaugen und/oder eine Erzeugung von Vakuum beinhalten.

4. Die Einrichtung gemäß Anspruch 3, wobei die An-

saugmittel und/oder die Vakuumerzeugungsmittel eine Luftansaugvorrichtung (9) umfassen, die mit einer Kammer oder einer abgedichteten Röhre (7) verbunden (8) ist, wobei sich die Kammer oder die abgedichtete Röhre in fluider Verbindung mit einem oder mehreren Ansaugstutzen befindet.

5. Die Einrichtung gemäß Anspruch 3, wobei die Ansaugmittel und/oder die Vakuumerzeugungsmittel eine Vorrichtung zur Erzeugung eines Pressluftstroms und eine Venturi-Vorrichtung zur Erzeugung eines Vakuums beinhalten zum Halten des Schuhs an der Sohle oder der Innengelenkstütze und/oder der Innensohle.

6. Die Einrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet**, das die Mittel zum Halten des Schuhs in einer stabilen Anordnung eine oder mehrere an dem wärmedämmenden Träger befestigte Saugnäpfe (4) beinhalten.

7. Die Einrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Mittel zum Halten des Schuhs in einer stabilen Anordnung erste mechanische Kopplungsmittel enthalten, die vorübergehend an den zumindest einen Teilbereich von zumindest einem der Schuhe koppeln und zweite entfernbare Kopplungsmittel aufweisen, die mit dem wärmedämmenden Träger verbunden sind.

8. Die Einrichtung gemäß Anspruch 1 oder 2, wobei die Schuhe (110) an einer entsprechenden Leiste (111) befestigt sind, **dadurch gekennzeichnet, dass** die Mittel zum Halten des Schuhs in einer stabilen Anordnung, eine Leiste mit magnetischen oder ferromagnetischen Mitteln (112) enthalten, die mit entsprechenden an oder in dem wärmedämmenden Träger angeordneten ferromagnetischen oder magnetischen Mitteln (113) zusammenwirken.

9. Die Einrichtung gemäß irgend einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das bewegliche Transportelement ein Förderband (5) ist.

10. Die Einrichtung gemäß Anspruch 9, **dadurch gekennzeichnet, dass** das Förderband ein Band aus einem metallischen Material enthält.

11. Die Einrichtung gemäß Anspruch 9 oder 10, wobei der wärmedämmende Träger zumindest ein Band aus einem Kunststoffmaterial enthält, das an der Außenseite des Förderbandes befestigt ist.

12. Die Einrichtung gemäß Anspruch 9, **dadurch gekennzeichnet, dass** das Förderband aus einem wärmedämmenden Material gefertigt ist und den wärmedämmenden Träger bildet.

13. Die Einrichtung gemäß irgend einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der wärmedämmende Träger aus Silikon gefertigt ist.

14. Die Einrichtung gemäß irgend einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der zumindest eine wärmedämmende Träger auf dem beweglichen Transportelement angebracht ist so dass dieser zumindest einen Freiheitsgrad bezüglich des beweglichen Transportelementes besitzt.

15. Die Einrichtung gemäß Anspruch 14, **dadurch gekennzeichnet, dass** der zumindest eine wärmedämmende Träger drehbar um eine Drehachse an dem beweglichen Transportelement angebracht ist.

16. Die Einrichtung gemäß Anspruch 15, **dadurch gekennzeichnet, dass** die Drehachse des zumindest einen wärmedämmenden Trägers im wesentlichen rechtwinklig zu der Bewegungsrichtung des beweglichen Transportelementes ist.

17. Die Einrichtung gemäß Anspruch 15 oder 16, umfassend zumindest zwei nebeneinander angeordnete wärmedämmende Träger, wobei die zwei wärmedämmenden Träger so angeordnet sind, dass von einem der vordere Teilbereich und von dem anderen der hintere Teilbereich des Schuhs gehalten wird und so mit dem beweglichen Transportelement verbunden sind, dass jeder der Träger sich um eine Drehachse-drehen kann, wobei die Drehachsen der beiden benachbarten Träger parallel zueinander stehen.

18. Die Einrichtung gemäß Anspruch 17, wobei die Drehachsen der benachbarten wärmedämmenden Träger im wesentlichen rechtwinklig zu der Längsausdehnung des Schuhs angeordnet sind.

19. Die Einrichtung gemäß irgend einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie einen oder mehrere Hilfsträger (315,315', 316) umfasst, um zumindest einen Teilbereich von zumindest einem der Schuhe zu halten, ohne dass der eine oder die mehreren Hilfsträger störend auf die äußeren Teilbereiche des Schuhs einwirkt bzw. einwirken.

20. Die Einrichtung gemäß Anspruch 19, **dadurch gekennzeichnet, dass** der eine oder die mehreren Hilfsträger zumindest den einen Teilbereich von einem der Schuhe auf der gegenüberliegenden Seite des auf dem wärmedämmenden Träger ruhenden Teilbereiches desselben Schuhs hält oder halten.

21. Die Einrichtung gemäß Anspruch 19 oder 20, **da-**

durch gekennzeichnet, dass der eine oder die mehreren Hilfsträger wärmedämmend sind, oder die Teile davon wärmedämmend sind, die mit zumindest dem einen Teilbereich der Schuhe in Berührung kommen.

22. Der Apparat (1) zur Wärmebehandlung von Schuhen, **dadurch gekennzeichnet, dass** in dem Apparat eine Fördereinrichtung (2) gemäß irgend einem der vorhergehenden Ansprüche für die Schuhe (10, 110) enthalten ist.

23. Der Apparat gemäß Anspruch 22, **dadurch gekennzeichnet, dass** ein Ofen zum Dehnen des Leders enthalten ist.

24. Der Apparat gemäß Anspruch 23, wobei der Ofen eine Einrichtung zum Einblasen von Dampf in den Ofen hinein enthält.

25. Der Apparat gemäß irgend einem der Ansprüche 22 bis 24, **dadurch gekennzeichnet, dass** ein Kühlsystem zur Inaktivierung von Klebstoffen enthalten ist.

Revendications

1. Dispositif formant convoyeur (2) pour chaussures (10 ; 110) dans un appareil (1) pour le traitement thermique, le dispositif formant convoyeur comprenant au moins un élément de transport mobile (5) pour une ou plusieurs desdites chaussures, **caractérisé en ce que** ledit élément de transport mobile comprend au moins un support thermiquement isolant (3) sur lequel une partie d'au moins l'une des desdites chaussures repose, et des moyens (4, 6, 7, 8, 9 ; 111, 112, 113) pour maintenir ladite chaussure en mise en prise stable avec ledit support thermiquement isolant, lesdits moyens étant formés pour se mettre en prise avec ladite au moins une partie d'au moins une desdites chaussures reposant sur ledit support thermiquement isolant, sans interférer avec d'autres parties externes de la chaussure ne reposant pas sur ledit support thermiquement isolant.

2. Dispositif selon la revendication 1, dans lequel ladite au moins une partie d'au moins l'une desdites chaussures reposant sur ledit support thermiquement isolant est choisie parmi la semelle, la semelle orthopédique ou la semelle intérieure.

3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** lesdits moyens pour maintenir ladite chaussure en mise en prise stable sont du type avec aspiration et/ou générant un vide.

4. Dispositif selon la revendication 3, dans lequel lesdits moyens d'aspiration et/ou de génération de vide comprennent un dispositif d'aspiration d'air (9) associé (8) avec une chambre ou conduit étanche (7), ladite chambre ou conduit étanche étant en raccordement de fluide avec une ou plusieurs buses d'aspiration (4).

5. Dispositif selon la revendication 3, dans lequel lesdits moyens d'aspiration et/ou de génération de vide comprennent un dispositif pour générer un écoulement d'air sous pression et un dispositif de Venturi pour générer un vide en correspondance avec ladite semelle ou ladite semelle orthopédique et/ou ladite semelle intérieure.

6. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** lesdits moyens pour maintenir ladite chaussure en mise en prise stable comprennent un ou plusieurs ventouses (4) fixées audit support thermiquement isolant.

7. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** lesdits moyens pour maintenir ladite chaussure en mise en prise stable comprennent des premiers moyens de couplage mécaniques temporairement couplés à ladite au moins une partie d'au moins l'une desdites chaussures et des seconds moyens de couplage amovibles raccordés audit support thermiquement isolant.

8. Dispositif selon la revendication 1 ou 2, dans lequel lesdites chaussures (110) sont montées sur une forme (111) correspondante, **caractérisé en ce que** lesdits moyens pour maintenir ladite chaussure en mise en prise stable comprennent ladite forme qui a des premiers moyens magnétiques ou ferromagnétiques (112) coopérant avec des moyens ferromagnétiques ou magnétiques (113) correspondants associés avec ledit support thermiquement isolant.

9. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit élément de transport mobile est constitué par une courroie transporteuse (5).

10. Dispositif selon la revendication 9, **caractérisé en ce que** ladite courroie transporteuse comprend une courroie réalisée avec un matériau métallique.

11. Dispositif selon la revendication 9 ou 10, dans lequel ledit support thermiquement isolant comprend au moins une courroie réalisée avec une matière plastique contrainte sur le côté externe de ladite courroie transporteuse.

12. Dispositif selon la revendication 9, **caractérisé en ce que** ladite courroie transporteuse est réalisée

avec un matériau isolant et forme ledit support thermiquement isolant.

13. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit support thermiquement isolant est réalisé avec de la silicone.

14. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit au moins un support thermiquement isolant est contraint sur ledit élément de transport mobile de sorte qu'il a au moins un degré de liberté par rapport audit élément de transport mobile.

15. Dispositif selon la revendication 14, dans lequel ledit au moins un support thermiquement isolant est contraint sur ledit élément de transport mobile de manière rotative autour d'un axe de rotation.

16. Dispositif selon la revendication 15, dans lequel ledit axe de rotation dudit au moins un support thermiquement isolant est sensiblement orthogonal à la direction d'avancement dudit élément de transport mobile.

17. Dispositif selon la revendication 15 ou 16, comprenant au moins deux supports thermiquement isolants adjacents l'un par rapport à l'autre, lesdits deux supports thermiquement isolants étant prévus pour contraindre respectivement la partie avant et la partie arrière de ladite chaussure, et étant raccordés audit élément de transport mobile de sorte que chacun d'entre eux peut tourner autour d'un axe de rotation, les axes de rotation desdits deux supports adjacents étant réciproquement parallèles.

18. Dispositif selon la revendication 17, dans lequel lesdits axes de rotation des supports thermiquement isolants adjacents sont sensiblement orthogonaux à la direction d'extension de ladite chaussure.

19. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il comprend un ou plusieurs supports auxiliaires (315, 315', 316) pour contraindre au moins une partie d'au moins l'une desdites chaussures, lesdits un ou plusieurs supports auxiliaires n'interférant pas avec des parties externes de la chaussure.

20. Dispositif selon la revendication 19, **caractérisé en ce que** lesdits un ou plusieurs supports auxiliaires se mettent en prise avec ladite au moins une partie de l'une desdites chaussures, sur la partie opposée par rapport à ladite partie de la même chaussure reposant sur ledit support thermiquement isolant.

21. Dispositif selon la revendication 19 ou 20, **caractérisé en ce que** lesdits un ou plusieurs supports auxiliaires sont thermiquement isolants, ou ses parties qui se mettent en prise avec ladite au moins une desdites chaussures sont thermiquement isolantes.

22. Appareil (1) pour le traitement thermique des chaussures, **caractérisé en ce qu'**il comprend un dispositif formant convoyeur (2) pour lesdites chaussures (10 ; 110) dans ledit appareil, selon l'une quelconque des revendications précédentes.

23. Appareil selon la revendication 22, **caractérisé en ce qu'**il comprend un four pour étirer le cuir.

24. Appareil selon la revendication 23, dans lequel ledit four comprend des moyens pour souffler de la vapeur dans ledit four.

25. Appareil selon l'une quelconque des revendications 22 à 24, **caractérisé en ce qu'**il comprend un système de réfrigération pour la désactivation des adhésifs.

Fig.1

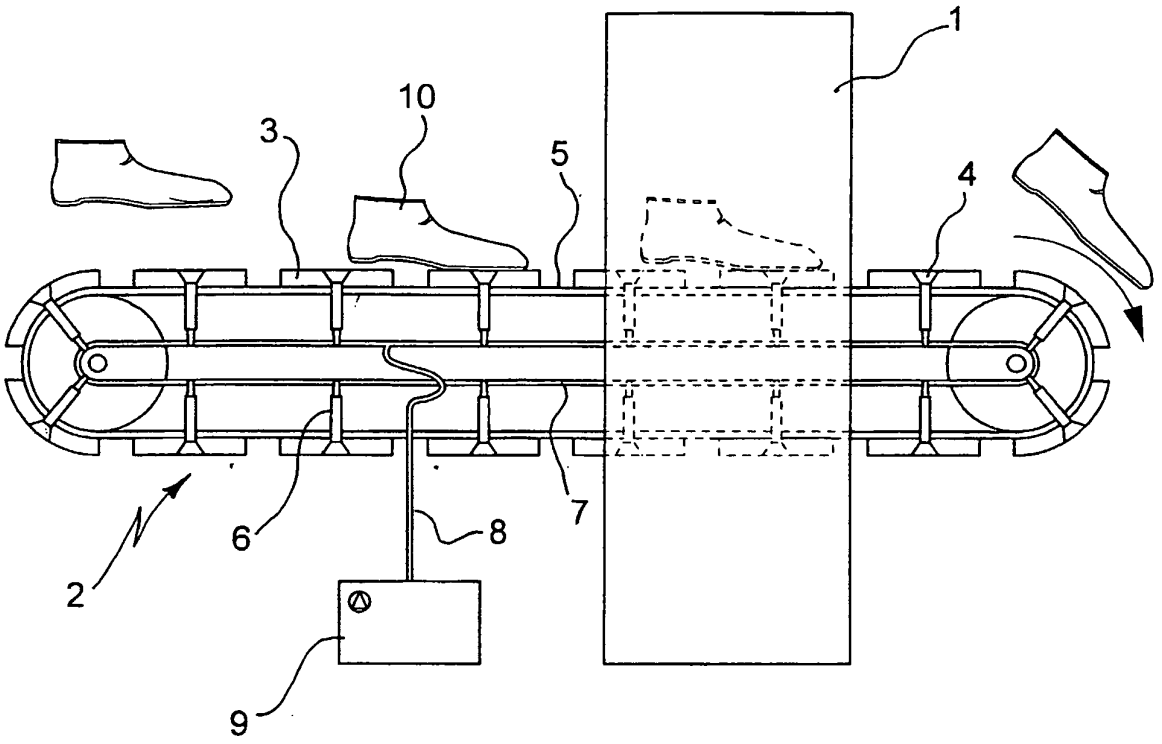

Fig.2

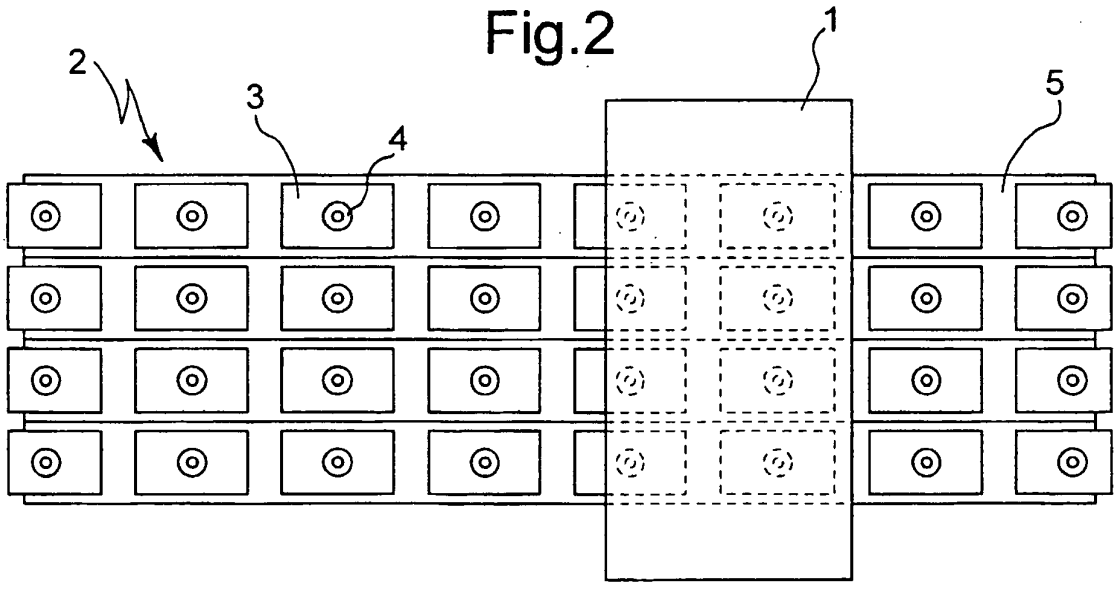

Fig.3

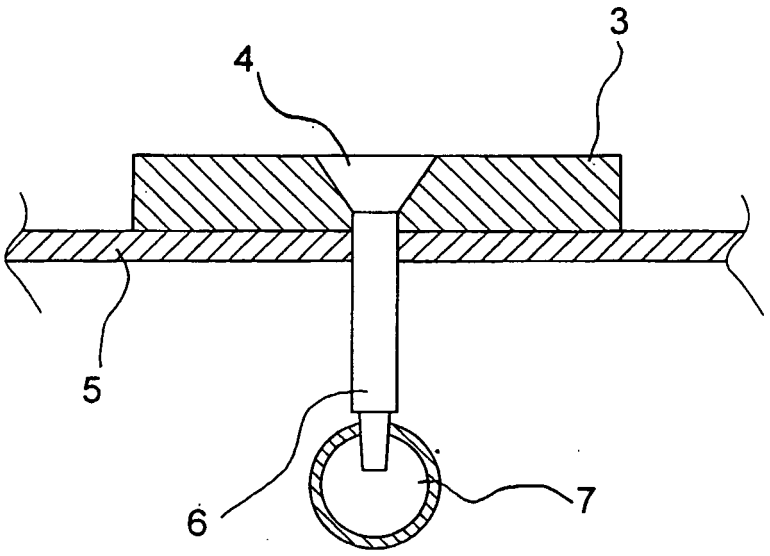

Fig.4

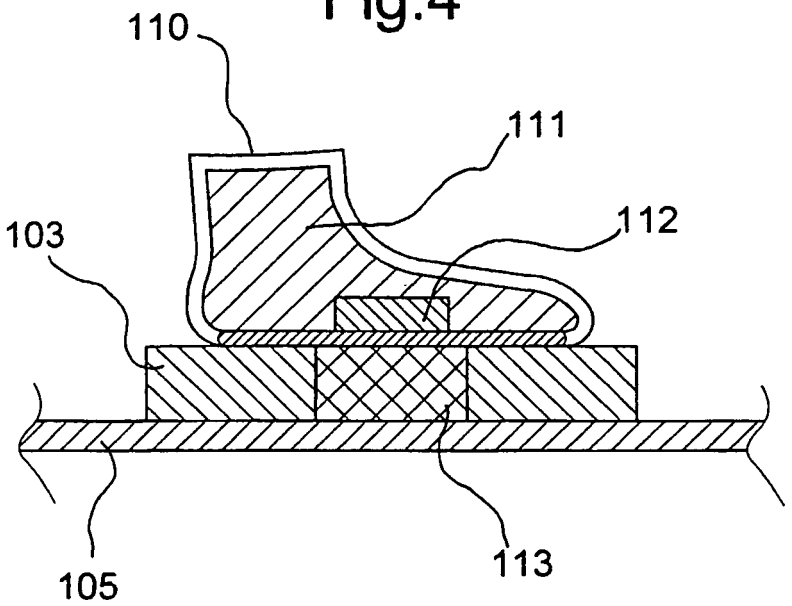

Fig.5

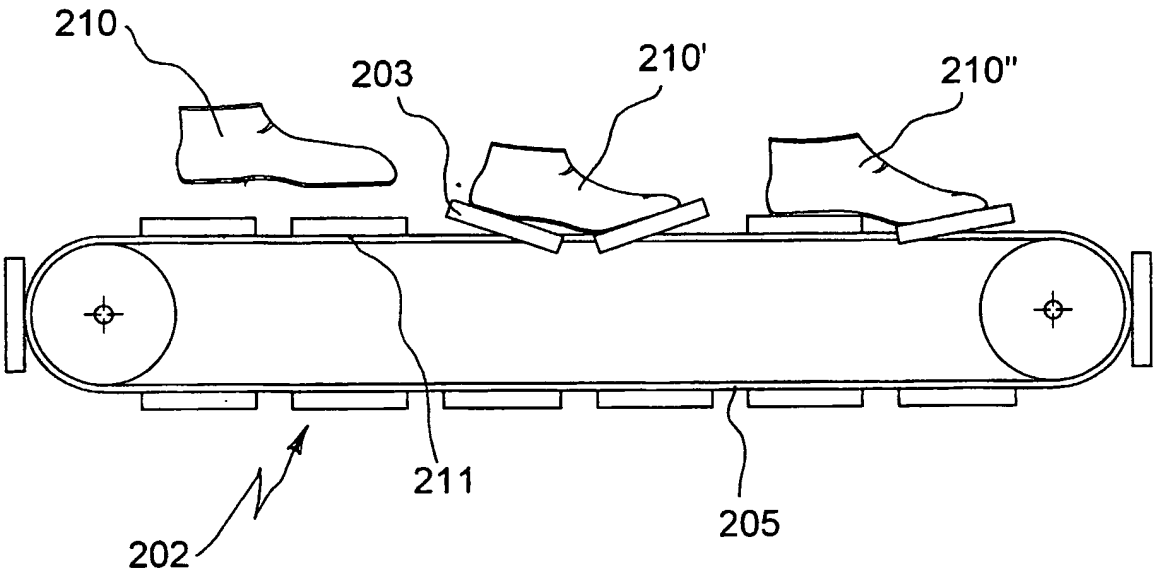

Fig.6

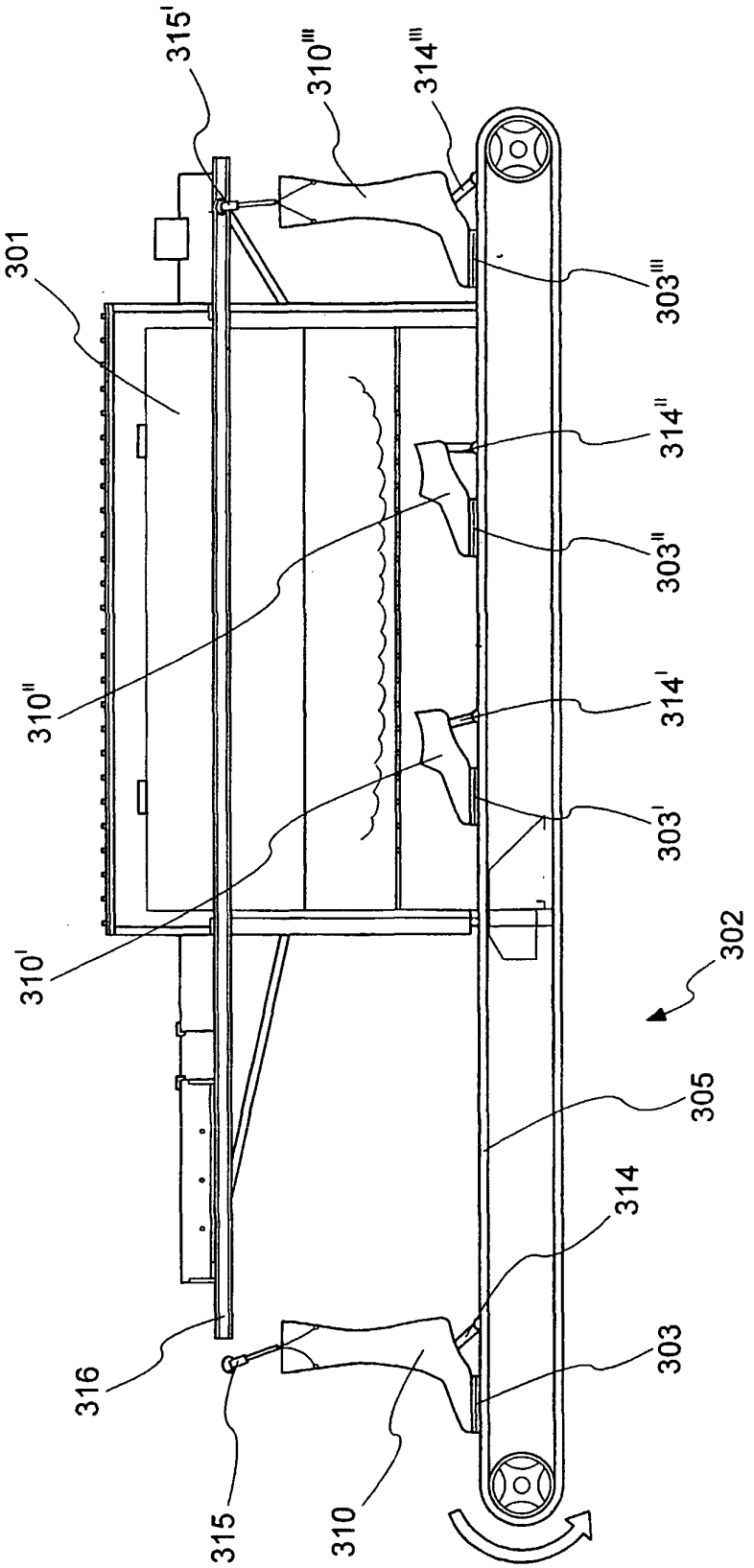
315'
310'''
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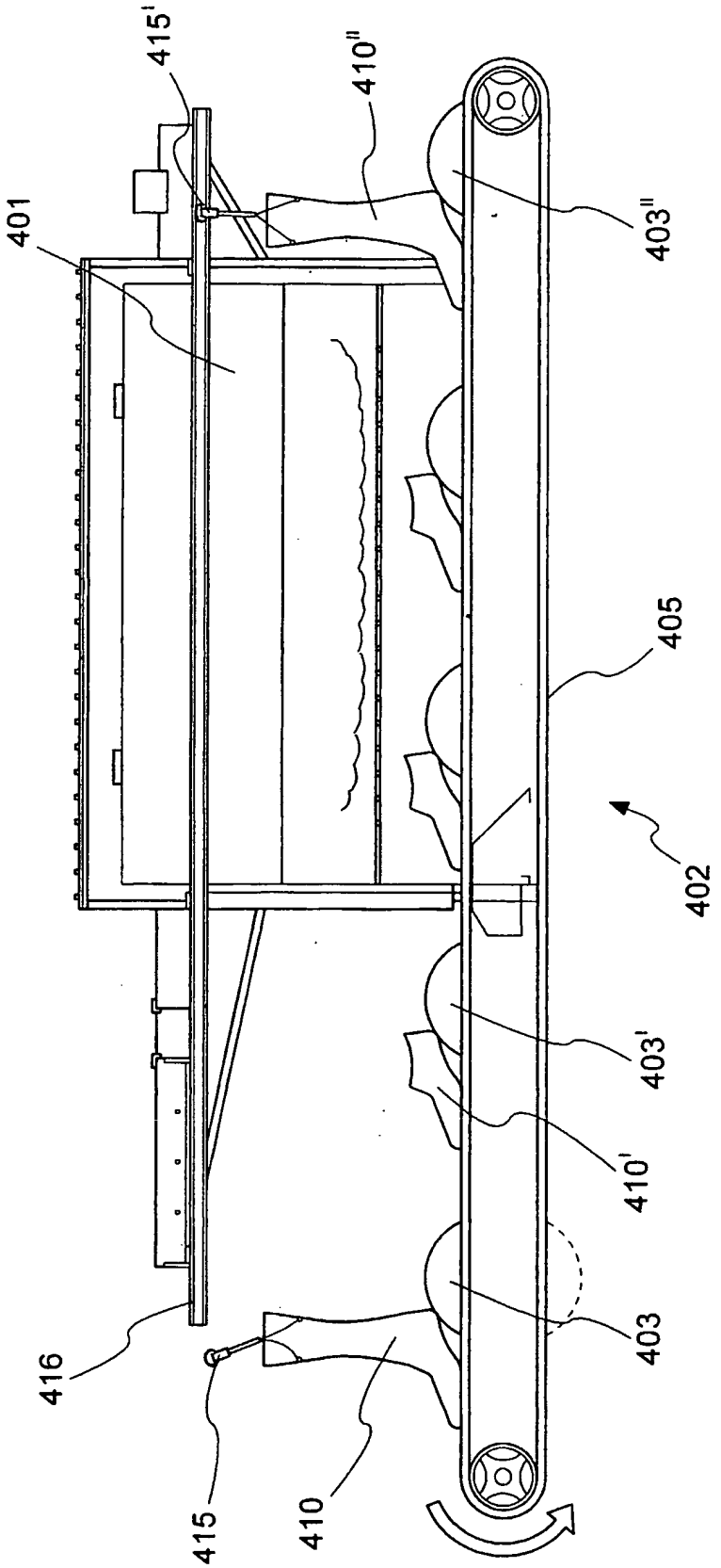
Fig.7



REFERENCES CITED IN THE DESCRIPTION

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