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(54) **Title**: MATTRESS MANUFACTURED WITH WOODEN COIL SPRINGS AND METHOD FOR PRODUCING THEREOF

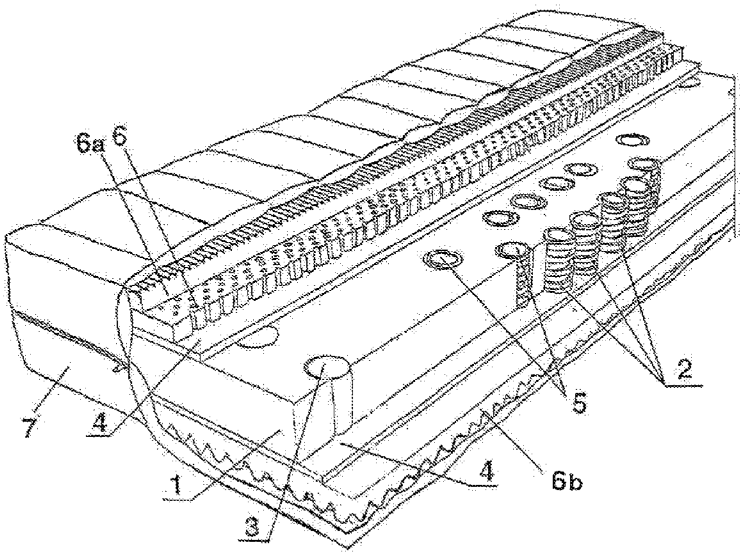

Figure 1

(57) **Abstract**: The invention is a mattress manufactured with wooden coil springs made from non-compressed hard or semi-hard wood, the mattress comprising several comfort layers, at least one stabilizing layer, an outside of the mattress, and a mattress core; and the method for producing thereof. It is characterized in that the wooden coil springs (2) are made from non-compressed hard or semi-hard wood, the cross-section of the wooden coil spring (2) is approximately rectangular, at least one end of the wooden coil spring (2) is secured to the stabilizing layer (4), most of the wooden coil springs (2) are positioned in the middle third of the length of the mattress core (1) for receiving a human hip region of a human body lying on the mattress.

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MATTRESS MANUFACTURED WITH WOODEN SPRINGS AND METHOD FOR PRODUCING THEREOF

The present disclosure relates to the field of mattresses made from wooden coil springs.

Mattresses typically use springs, such as helical coil springs made of metal, to provide support for the body, and to provide a degree of alignment for the spine and a springy and comfortable feel for the user of the mattress. Helical coil springs or compression springs absorb the weight of a person and provide support, including support for the hips, spine and shoulders.

Designs and methods for producing a mattress having embedded springs are well known. See, for example, U.S. Patent No. 4,154,786 (Plasse). Pocket spring technology in which springs are separated from one another by a material, such as a fabric material, are also known see, for example, U.S. Patent Application Publication No. 2004/0025257 (Ahlqvist) and U.S. Patent Application Publication No. 2005/0257323 (Edling). The contents of U.S. Patent No. 4,154,786 and of U.S. Patent Application Publication Nos. 2004/0025257 and 2005/0257323 are incorporated in full by reference herein.

People are concerned with electric and magnetic fields induced by steel or other metal coils inside a mattress, especially since they spend a third or more of their lives on or near the mattress. Some studies have shown the deleterious effects for blood circulation, and other adverse physiological effects, caused by such electrostatic noise induced in or by metal coils. The effects of such fields and noise on human health and brain functioning are not fully understood at the present time.

There is thus a need for alternative types of mattresses that use more organic material-based compression coils. In addition, wooden coil springs may have a longer useful life, and may reduce or eliminate audible noises from the mattress.

Rattan, reed and other types of cane have been used to provide support and comfort for a person lying or sitting. For example, U.S. Patent No. 5,596,777 (Polus), the content of which is incorporated in full by reference herein, describes such a solution. However, rattan springs typically require a stabilizing or hardening frame.

EP 1.048.248 A1 (Recticel) describes a mattress with spiral spring core. The material of the spring is rattan or willow. The description does not disclose the manufacturing of the wooden spring and does not teach whether the spring is compressed or non-compressed. The cross-section of the spring is circle; the spring is cylindrical and prepared from withy. This kind of formation does not allow the spring to store energy, as well as this cylindrical shape makes the spring less durable. There are more disadvantages of the product, for example the materials used for producing the spring are rattan and willow that are weak for performing as mattress springs. Moreover, these mentioned materials dry quite fast and as a result the springs break and cannot function as durable, long-lasting springs. Another reason for this is that the rattan coils react very badly to the impacts. When someone jumps on the bed or a heavy person hit the coils in the mattress the rattan coils will break easily. That is why latex blocks are always necessary to be placed around rattan coil rows. Otherwise it would not be necessary to have latex rows and pockets between the coils, as they make the producing more complicated and expensive. Pre-stressing the springs is also an unnecessary step in the manufacture. It is possible to create coils that are supportive enough without any pre-stressing.

EP 0 694 272 describes a mattress that has helical springs formed from bent rattan tubes and are arranged in adjacent rows. The springs are fixed to a grid consisting of wooden bars or strips.

Compression springs made of compressed wood are known. For example, HU 226.783 and the same EP 2.002.759 (Szabo, Eckardt, Czel), the content of which is incorporated in full by reference herein, describes an energy storing compression spring made of compressed wood.

Wood can be compressed before it is bent. This is usually done on a wood pressing or compressing machine, and the wood is typically left in the machine for many hours. If the compressing is successful, the fibers of the wood have shifted in position and the wood becomes flexible and bendable even in the cold state. This is sometimes known as cold bending.

An advantage of using non-compressed wood, however, is that it may require fewer processing steps or shorter processing time to produce the coils. Also, non-compressed wood processing allows for greater control of the size, including the length and cross-section, of the slat that is formed into the coil, and greater control over the orientation and position of the last turns of the coil, and thus greater control over the size of the end turns of the coil. In addition, compressing wood can change the internal wood fibers such that the wood becomes more difficult to shape and sand. Compressed wood can tear or rip more easily when it is chiseled or sanded, or chunks of the wood can thus become loose.

Compressed wood loses up to 20 % or more of its original length. Since a piece of wood to be made into a coil must be knot-free, the presence of knots in the wood limits the maximum length of a piece of wood that is usable for making a coil. Therefore, the length of coil springs that can be made of compressed wood is shorter than it would be if the wood did not have to be compressed. In addition, wood compressing machines are expensive, the compression process takes many hours and consumes significant energy, and the lack of availability of compression machines in sufficient quantities limits the amount of wooden springs that can be produced. In addition, wood that is not freshly cut can become deformed during compression. Thus, wood to be compressed should be obtained early in the season, for example, by spring or by April. Such wood must be stored in a careful way after its compressed and must be used within a relatively short time, such as within 6-9 months after compression. Compressed wood that is stored for longer periods often does not stand up to the requirements for wooden springs or even for other uses, or may produce inferior quality products. Wood can store moisture between its grains or inside its plant cells. Wood that is stored for a prolonged period of time can tend to dry, which is a result of water leaving the cells. If the wood is left for a longer period, then continued drying of the wood will affects its mechanical properties, as the wood begins to shrink and to get harder. Once wood becomes dry after prolonged storage, its moisture cannot be reliably restored before compression. Compressing such wood can deform the wood in undesirable ways and such wood can yield an inferior product after compression.

A process of producing wooden springs from compressed wood also involves steaming or warming and then drying of the wood. In fact, in the case of the manufacture of wooden springs, repeated drying may be necessary. These very energy intensive steps are not necessarily required for the production of wooden springs from non-compressed wood. Thus, the same amount of raw material will yield a greater amount of product for non-compressed wood, a smaller carbon footprint may be achieved using non-compressed wood processing, and a less costly process involving reduced need for energy may be obtained for the production of wooden springs using non-compressed wood processing. Also, longer wooden springs may thus be obtained.

Compression of the wood results in a spring with greater spring bias or greater spring force. This is caused by the greater stresses in the wood caused by the compression. This compression, however, may create a greater, stronger spring that is capable of working harder longer. This spring force cannot be decreased beyond a certain minimum force for any given spring height. Thus, a softer, less firm feeling spring can be generated with coil spring made from non-compressed wood.

Non-compressed wood, since it requires fewer processing steps than wood that is subjected to heavy pressure and compression, may be described as a more “natural”, less processed wood product, and marketed as such.

It has been found, however, that non-compressed wood is also bendable if steamed, in a process sometimes known as the Thonet process. While the Thonet process is known, the following description provides, among other things, a new method for using non-compressed wood to make wooden spring coils.

Described are wooden coil springs, including those made of non-compressed wood, and mattresses with such coil springs. Also a method of producing a coil spring made of non-compressed wood is described.

Such a method includes: wrapping a slat of wood on a reel and securing the slat on the reel to form the coil spring from the slat; steaming the coil spring on the reel; drying the coil spring; and shaping an end turn of the coil spring.

According to this method, the drying may be performed with the coil spring on the reel without removing the coil spring from the reel before the drying.

The wrapping and securing the slat may include securing a first end of the slat on the reel, winding the slat around the reel, and clinching the second end of the slat. The wrapping of the slat may include winding the slat around the reel at least two times. The wrapping of the slat may include positioning, as a guide reel, a second reel to guide the slat.

The drying may include irradiating the coil spring. The coil spring can have a longitudinal axis, and the shaping of the end turn may include:

positioning a spacer at an outer major surface of he end turn, the outer major surface being transverse to the longitudinal axis, the spacer positioned substantially perpendicular to a longitudinal axis of the coil spring, such that the spacer prevents movement of the coil spring along the longitudinal axis toward the spacer; and positioning a device immediately adjacent an end of the end turn, such that the device prevents movement of the end of the end turn in a circumferential direction with respect to the longitudinal axis.

The coil spring may have a cylindrical shape. The reel may also have a cylindrical shape. The coil spring may have a cone or truncated cone shape. The reel may have a cone or truncated cone shape. The coil spring may have at least three turns, each turn having a diameter smaller than an immediately adjacent turn.

The end turn may have a diameter substantially equal to the immediately adjacent turn. According to such a method, the shaping of the end turn may include: configuring the end turn such that an outer surface of the end turn facing away from any adjacent turn of the coil spring is substantially perpendicular, for at least 180 degrees of the end turn, to the longitudinal axis of the coil spring.

The shaping of the end turn may include joining and securing together at least two turns of the coil spring to form the end turn. Further, the shaping of the end turn may include decreasing a thickness of the end turn, the thickness being a shortest dimension of the slat that forms the coil spring. The shaping of the end turn may include decreasing a width of the end turn, the width being a dimension of the slat that forms the coil spring greater than a thickness of the slat but smaller than a length of the slat.

Also, a wooden coil spring produced according to this method, and mattress including such a wooden coil is disclosed. A support pad, for example, for a sofa, chaise, lounge chair, chair or other supporting surface made of a wooden coil spring produced according to this method are also contemplated.

Also disclosed is a wooden coil spring made of a slat of wood having a first thickness at a first point in a longitudinal direction different from a second thickness at a second point of the slat in the longitudinal direction. Such a wooden coil spring may be made of non-compressed wood.

Such a coil spring may have a cylindrical shape, a cone shape or a truncated cone shape. Such a coil spring may include at least three turns, each turn having a diameter smaller than an immediately adjacent turn. An outer surface of the end turn facing away from any adjacent turn of such a coil spring may be substantially perpendicular, for at least 180 degrees of the end turn, to the longitudinal axis of the coil spring.

Such a coil spring may have a helical rise in a range of 3-45 degrees. Also described is a mattress that includes such a coil spring. Further described is a mattress that includes: a core layer that includes a first plurality of wooden coil springs made of non-compressed wood positioned at a first area of the mattress, and a second plurality of wooden coil springs made of non-compressed wood positioned at a second area of the mattress different from the first area, wherein the first plurality of wooden coil springs provides a firmness firmer than the firmness of the second plurality of wooden coil springs.

In such a mattress, first area of the mattress may correspond to an area for receiving a human hip region of a human body lying on the mattress. For example, the first plurality of wooden coil springs may include coil springs shorter than coil springs of the second plurality of wooden coil springs. The first plurality of wooden coil springs may include coil springs each with an end turn thicker than end turns of the coil springs of the second plurality of wooden coil springs. The first plurality of wooden coil springs may include coil springs each with a course of compression shorter than the course of compression of each of the coil springs of the second plurality of wooden coil springs.

In such a mattress, the core layer may include a plurality of recesses, each recess sized and positioned to receive a wooden coil spring of the first plurality of wooden coil springs and the second plurality of wooden coil springs.

The wooden coil springs of such a mattress may include wooden coil springs of cylindrical shape. The second plurality of wooden coil springs may include coil springs of cone or truncated cone shape.

The wooden coil springs of such a mattress may include coil springs of cone or truncated cone shape positioned such that a narrower end of the cone or truncated cone faces toward a top of the mattress. In such a mattress, some wooden coil springs may be of cylindrical shape and some wooden coil springs may be of cone or truncated cone shape.

In such a mattress, a wooden coil spring may have an end turn with a smaller width than remaining turns of the wooden coil spring. In such a mattress, the end turn may have a major outer surface facing away from any adjacent turn of the wooden coil spring and substantially perpendicular, for at least 180 degrees of the end turn, to the longitudinal axis of the wooden coil spring. In such a mattress, the first plurality of wooden coil springs may be positioned in a first insert, and the second plurality of wooden coil springs may be positioned in a second insert, the first and second inserts positioned in the core layer. The core layer may include at least three inserts, each insert positioned to correspond to a different region of a human body lying on the mattress. For example, at least one of the inserts may have a first wooden coil spring providing a first firmness, and a second wooden coil spring providing a second firmness firmer than the first firmness.

In such a mattress, each spring of the first plurality of wooden coil springs and the second plurality of wooden coil springs may be positioned in a separate pocket. A stabilizing layer may also be positioned in the mattress parallel to the core layer, wherein each coil spring of the first plurality of wooden coil springs and the second plurality of wooden coil springs is secured to the stabilizing layer. In such a mattress, the wooden coil spring may be formed of a slat, and a width of the slat at a first portion of the wooden coil spring that corresponds to an end turn of the wooden coil spring may be smaller than widths of the slat corresponding to remaining turns of the wooden coil spring, the width being a dimension of the slat greater than a thickness of the slat but smaller than a length of the slat.

DETAILED DESCRIPTION

Mattresses typically use springs, such as helical coil springs made of metal, to provide support for the body, and to provide a degree of alignment for the spine and a springy and comfortable feel for the user of the mattress. Helical coil springs or compression springs absorb the weight of a person and provide support, including support for the hips, spine and shoulders. Mattress as used herein may include various types of reclining or sitting support surfaces, including sofas, chaises, couches, reclining chairs, beach chairs, chairs, comfort and support pads and add-ons to the foregoing and combinations of the foregoing.

Wooden compression spring coils and their shapes, relative proportions and dimensions, a method of producing such wooden springs, and mattresses incorporating such wooden springs, will now be described.

Wood, generally hard wood raw material, is selected that is, ideally, not pre-dried and is relatively knot-free. Also, the wood, ideally, should be free of cracks and breakage, and should have moisture content between 15-25 %. The wood, ideally, should have appropriate fiber content. The wooden springs can be made from various types of woods such as oak, beech, cherry, walnut or other nut tree, or any hard and semi-hard woods.

To test the bendability of the wood, a plank of 1600 mm x 14 mm x 13 mm may be cut, and may be planed, for example using an electric or other planar machine or a handheld planar or other such device. The plank may then be steamed at between 80 EC – 100 EC and at a pressure of 0.6 ATM – 1 ATM for ten minutes. Then the moisture content of the plank may be checked, and steaming can continue until the moisture content is between 40 and 80 %. At this stage, the plank should undulate when shaken. The wood can then be wrapped on a reel, for example, on a cylindrical reel 8cm in diameter, and if the plank can be wound around the reel twice without breaking, then the wood is probably suitable for the manufacture of the wood springs.

After the wood selection, the wood is cut into planks. Each plank may be 1600 mm – 2000 mm in length, which may yield a coil spring that is 1230 mm in height. The plank is sawed, milled, or otherwise cut into slats of suitable length to produce each coil. The wood may be planed, using an electric wood planar machine, handheld planar or other device.

The slat length will vary depending on the desired target height of the coil spring, for example, the slat raw, pre-processed length may be 2000 mm – 2200 mm to produce a slat that is 2000 mm or shorter in height after steaming and drying. To produce a coil spring that is 1230 mm (48.425 inch) x 13mm x 6mm, planks could be cut to 1620 mm x 80 mm x 26 mm size. Slat length can vary between 80 cm and 300 cm, depending on target length of the coils. Each such plank could be further cut to slats of size 1600 mm x 14 mm x 13 mm.

The length of the starting material for the coil can vary between 470 mm and 3000 mm or longer. For example, the thickness of the slat may be 5-11 mm, which typically could yield a finished product, after drying, cutting and sanding of 4-10 mm. The width of the slat may be 5-21 mm, which can yield a finished product 4-20 mm in width.

Thickness as used herein may mean the shortest dimension of the slat, or the distance measured in a radial direction of the coil from the outer circumference of the coil to the inner circumference of the coil.

Width as used herein may mean the dimension of the slat greater than thickness but shorter than length, or the distance in an axial or longitudinal direction of the coil that measures the height of the wooden material that forms the coil at one turn.

The outer diameter of the coil may be 28 mm-110 mm, but after drying and processing this may change to 26 mm-108 mm. Sizes may change with steaming and drying. The following table provides examples:

Section size (mm)	Diameter (mm)	Free Height (mm)	Solid Height (mm)	Force (N)	Spring Constant (N/m)	(kg/m)
123 x 13 x 6	80	120	60	50	833	83
160 x 13 x 6	80	160	72	40	455	45
190 x 13 x 6	80	190	90	65	650	65
110 x 13 x 6	40	110	65	100	2200	220
115 x 12 x 4	40	115	65	50	1000	100

Free height is the height of the spring without any compression; solid height: Height of the spring when it is fully compressed; force: The needed force to fully compress a spring; spring constant: How much force (N) is needed to compress a spring 1 meter long [(Higher spring constant means higher spring resistance) Spring constant = Force / (Free height-Solid height)]

To achieve the 2000 mm target length of material, the starting length of the slats may be 2000 – 2200 mm before the steaming and drying steps. The maximum length of the slat used to produce coil may be around 300cm but, in theory, if longer slats can be obtained that are knot-free, then taller coil springs can be produced. The helical rise may be between 3 E and 45 E.

The inner diameter of the helical coil may be 20 mm – 100 mm. The spring force of the coil is inversely proportional to helical rise. The greater then helical rise, the weaker the spring force, all other features being equal.

A general rule is that the height of each turn of the coil should be greater than the thickness of the wood material of the coil. For example, the diameter of the coil may be between 2 cm and 11 cm. The thickness of the material of the coil may be between 4 mm and 10 mm. The outer diameter of a coil made of wood of such dimensions may be, for example, between 26 mm and 110 mm. Below a thickness of 4 mm, the material of the coil may become unstable and bend, whereas above 10 mm, the coil can become very stiff.

In general, a slat that is bent could have a length between 60 cm and 220 cm. But the necessary length of the slat before the bending depends on several factors, including the final length of the coil and the helical rise of the turns. For example, producing a soft 120 mm height coil, a 500 mm long slat (before bending) may be sufficient if the helical rise is around 45 E. Typically, the slat would be between 6 mm and 13 mm wide and between 5 mm and 9 mm thick.

The slats thus cut may then be wound on a reel. For example, a cylindrical reel template made of metal may be used. Each slat can be wound around the cylindrical wheel using a second cylindrical guide reel to wrap the slat, and to produce the coil. The end of the slat can be fixed to a portion of the winding reel, and the second end of the slat can be clinched or otherwise attached to the winding reel. The size of the guide reel can vary with the dimensions of the desired target wooden coil, for example, its length, width and thickness. It will be understood that other ways of creating a coil out of a wooden slat are also possible. The slats can then be steamed as described above for 10 – 90 minutes but often for 30 minutes or less.

The precise steaming time for the wood depends on the species of tree used, and within each species, the steaming period for any given lot of wood will vary depending on the grain, the season, how long ago the wood was cut, the moisture content, the ambient humidity during storage and other factors. Typical steaming time is between 10 and 30 minutes but may take 10-90 minutes. After 90 minutes of steaming, if the wood still has not reached the proper moisture content of between 40 and 80 %, then the wood can be soaked in water for 24 hours and then steaming can be tried again. Such soaking opens the grains of the wood for the subsequent steaming step.

Following the winding step, the coils are dried. For example, each coil may be separately clinched on a cylindrical reel and may be covered and held tightly. The outer diameter of the cylindrical reels may correspond to the inner diameter of the coil. Each coil may be dried individually in its own drying chamber. Also, the coil may be dried in a convection or other type of oven, or may be irradiated, for example, using high frequency radiation, microwaves and/or infrared, which could substantially shorten the processing time required for the drying step. During the drying, the coils can remain secured to the same reels to which they are attached in the winding step.

In a traditional drying process, drying time may be 20 – 40 minutes. The coils can be considered dry when their moisture content is between 6 and 12 %. For many types of wood, the moisture level must be less than 10 % after the drying. Typically, when drying a new lot of wood, an initial drying period can be tried, the moisture content can be measured and additional drying can be applied. Also, the moisture content can be continuously monitored during the drying process, or it may be periodically monitored throughout the drying process. It will be understood however that drying time is dictated by the wood's unique properties, the species of wood, the season of the year and other such factors.

Next, the dried coils are removed from the reels and are cut to their final coil dimensions, for example, using a CNC machine. In this way, the coils are cut to size. Further, they can be sanded or scraped or otherwise finished. For example, the outside of each coil can be sanded or scraped, using a sanding or scraping machine head, while the inside of each coil can be similarly sanded or scraped or may be sanded or scraped using a hand held device. For example, if the same head is used to sand or scrape both the inside and outside of the coil, then the coil may be secured or affixed or held when the sanding or grinding or scraping head is applied to the outside of the coil. If the thickness of the material before sanding ranges from 5-11 mm, then after sanding or shaping thickness may be 4-9 mm.

The dry coils are removed from the reels and their ends may be glued. The coils are then cut to size, for example using a CNC machine, while the coils are in a non-compressed state.

The producing machine comprises a positioning box that facilitates controlling where the end of the coil should be and where it is to be cut. The machine also comprises a spacer that is a piece of wood, but it will be understood that other kinds of spacers, and spacers made of other materials, may also be used. The spacer indicates where the coil is to be cut along its axial length. Then the coil may be turned so its other end can be cut to length as well. Or, two saws, such as a double-headed circular saw with the heads set to a desired size, may be used to cut simultaneously both ends of the coil. For example, a cutting template may be set at 130 mm so that both ends of the coil are cut simultaneously for a 130 mm length coil. The coil may reach its final length after it is sanded/scraped/chiseled or the like.

Two different coils may be processed next to each other, such that the end turns of each coil are held in the same drying template or device. This facilitates the gluing process, since two coils are processed in the same gluing step in the same device.

According to the requirements of the mattress, during this final cutting step, the last turns of the coils are formed. The final turn of each coil is between 5 and 300 % of the height of the other “intermediate” turns of the coil. For example, if each intermediate or standard turn of the coil is 13 mm in height, then the height of the final turn of the coil can be between 0.65 mm and 39 mm. The shape and dimensions of the last turn of the coil has important consequences for the course of compression of the coil. The course of compression, or the spring stroke length, equals the height at its “free height” or relaxed non-compressed state, minus its “solid height.” The solid height is the position at which the coil has been loaded and has reached its most compressed state. At the solid height, each turn of the coil may be touching its adjacent turns.

In general, the thicker the end turn, or both end turns of the coil, the shorter the course of compression. Thus, thicker end turns mean that the coil reaches its state of total compression faster and becomes harder faster, and a mattress (or a portion of a mattress) using such coils may feel firmer.

If the material of the end turn of the coil is wider, for example, three times wider than the width of the material of the remaining turns, then the coil has less springing force, that is, the coil soon reaches its hard supportive position as a supporting element of the mattress. The height of the coil, and the size and relative proportions of the end coil, allow for great variation of the overall support and feel provided by the mattress. For example, at the portion(s) of the mattress corresponding to the shoulders of the person lying upon it, the coil may be approximately 16 cm in height for a softer, cushier feel, or 12 cm in height for firmer support. For the thoracic spine, the coil springs of the mattress may be 12 cm in height because these springs support less weight, while at the hips, a 16 cm tall coil spring may be used in the mattress for a softer, cushier effect. In this way, the springier support allows for more "give" and thus the person lying on the mattress experiences more alignment of the shoulders, spine and hips, even when lying on his or her side. That is, a 16 cm coil spring could feel more springy or softer and could provide more "give" and thus, since the person's shoulder and hips are allowed by the coil springs to sink more into the mattress, the alignment of the head, neck, shoulders, spine and hips may be more natural and healthy.

Narrower end turns are thus often more desirable to achieve a springier feel for the coil. There may be up to an 11 mm variation in the compression distance (course of compression distance between free height and solid height of the coil) between coils of identical length. This variation is determined by the width of the end turns.

The slat that will be bent into the coil can have a consistent thickness and width throughout its length. Alternatively, the thickness and/or width of the slat can be varied because different widths and thicknesses produce different properties for the final coil spring. In addition, since during the soaking or steaming steps of the wood, the outer shell of the wood can become cracked at several points, milling of the slat to remove such cracked portions allows such remaining portions of the slats, which would otherwise be wasted, to be used. One end turn of the coil may have a different thickness then the end turn at the other end of the coil spring. Thus, the coil spring may be asymmetric. The thickness of a slat can be varying. In addition, the height of each turn of the coils can be decreased. Upon compression, each turn of the coil will not be completely flush with adjacent turns. Thus, there will be portions of the coil where at the point of total compression or "solid height" air will still be able to escape at the sides between turns from the spring. Thus, a more airy spring can be created. This may be important for marketing purposes because a more airy looking spring can be provided to the customer.

A coil can have several turns at one or both of its ends, for example, between one and three "end turns" joined together, for example, using glue, one or more screw(s), bolt, bracket, nail and/or rivet or other fastener, including ropes and bands, to produce thicker end turns. Each of the turns can be between 5 and 300 % of the size of the "regular" remaining non-end turns of the coil. Wood file, sanding, scrapping, grinding or milling, for example can shape the ends, using emery.

In general, all other factors remaining unchanged, thicker end turns create a coil spring that requires more force to reach total compression, or its "solid height," the point at which no further compression is possible. At this point of total compression, each of the turns may be touching adjacent turns. Conversely, if the end turn, or, as discussed above, if both of the end turns of the coil spring, is made of thicker material, then a firmer feel is achieved for the sleeper on the mattress. Stated differently, with a different end turn, the spring stroke length, or course of distance compression, decreases. Thus, by varying the end turns of the coil spring, the designer can vary the support firmness provided by the mattress. A thicker end turn provides a firmer support, assuming other factors, such as helical rise and the like, are kept unchanged.

Accordingly, after the formation of the coil, several turns at the end may be glued or otherwise secured together, as illustrated in Figs. 10-12. In this way, a wider final end turn may be produced, thus creating a coil spring that provides support of greater firmness. In addition, the end turn on each of the ends of the coil spring may thus be varied, for example, may be made more wide by gluing, screwing, bolting, nailing, bracketing or attaching or otherwise securing together the final turns on both ends of the coil, to produce a coil spring with more firmness. The thickness of an end turn or of both end turns may also be modified after processing to change the spring characteristics and comfort provided by the coil. Also, an end portion, or both end portions, of a slat may be modified before or during processing so that the resulting wooden spring has an end turn, or both end turns, with a target width and/or thickness, or so that the resulting coil has an end turn, or both end turns, with a width and/or thickness of a target relation or ratio or proportion to the widths and/or thicknesses of intermediate or remaining turns of the coil.

The slat used for making the coil is thinner at the beginning and end. For example, the first and last third of the slat may be thus thinner. By producing such a coil, an "airier" looking coil can be produced. This gives the aesthetic impression of a "lighter" and more breathable coil and mattress. There might be a wooden spring with a thinner top portion. A wooden spring having thicker end, an increased solid height and thus a decreased stroke length gives less total resistance before reaching its solid height. In this way, making the material thinner or narrower at one or more parts thereof may make identical length coils more or less springy. Thus, by sanding, scraping, chiseling or otherwise making thinner or narrower the material of the wooden spring, even after it is near completion, a different feel for the wooden spring can be achieved.

With compressed wood that is bent into coils or helices to produce the wooden springs, it is difficult or impossible to control the end turns or the number of end turns or their thickness. Typically, there will be great variation also between springs in terms of orientation or position of the portions that correspond to the last turns. After gluing or otherwise fixing the end turns of coil, the outer lateral surface of the end turn is cut and sanded to achieve a right angle or near right angle with respect to the longitudinal axis of the coil. When using compressed wood for producing the coils, stresses are built up in the grains of the coil, which produces internal pressures in the coil that can distort the shape of the wood and cause deviation from the end turn being perpendicular to the longitudinal axis of the coil. Such perpendicular or near perpendicular positions, where the drying coils have lateral outer end turns that are nearly at right angles with respect to the longitudinal axis of the coil. Perpendicular as used herein may mean within manufacturing tolerances of 90 degrees. Substantially perpendicular may mean within 15 degrees of perpendicular. Substantially equal may mean not varying at greater than by an acceptable tolerance range for the industry. Typically, at least a 180 E portion (a near semi-circle) of the end turn needs to be at right angle or near right angle to achieve good gluing of the end turns. Thus, sanding and cutting such ends to try to produce an end that is perpendicular to the longitudinal axis of the coil can cause loss of significant material. With compressed wood, as discussed, the distortion caused by the internal stresses of the wood, cause distortion that is difficult and impossible to reverse. Therefore, to ensure such a perpendicular end turn, the coil needs to be produced from a slat of additional length so that the end turns can be cut as needed to yield the perpendicular end turns.

Accordingly, an advantage of using non-compressed wooden spring according to our invention is that since there is likely to be less distortion, or at least distortion that cannot be corrected, producing an end turn that has a lateral outer side that is perpendicular to the longitudinal axis of the coil is more predictable. This in turn, as discussed, can result in less waste, since most of the time the slat need not be substantially longer than necessary to yield a working margin after it is dry. On the other hand, with non-compressed wood, it is easier to control the thickness of the last turns of the coil spring and to control their uniformity. Thus by controlling the last turn, or the end turns at both of the ends of the coil spring so that the last turn is thinner or thicker than the material of the remaining turns of the coil spring, the firmness of the spring can be controlled. For example, if the average turn has a height of 13 mm, then the last turn can have a height between 0,65 mm and 39 mm, that is the last turn can be between 5 % and 300 % of the remaining turns or intermediate turns or non-end turns of the coil spring. In this way, production of spring coils with advantageous torque strength for average weight shapes of approximately between 50 Nm and 70 Nm may be possible.

The wooden springs can be made in different diameters, different heights, and due to the different size of coil end-turns with different stroke. The difference between the stressed and pre-stressed size of coils has huge effect on the coils (and wooden spring mattresses) supportive function. The lower the difference is the lower the level of support that coils provide on different part of laying body. It is important characteristic because human body needs different support on its different parts (zones). That is why most of the springs are arranged in the middle third of the length of the mattress core, to provide support for the hip area.

The wooden spring can have a cone-shaped or truncated cone-shaped profile. With such a cone or truncated cone profile, each turn of the coil has a diameter slightly smaller than the previous adjacent turn. In this way, one end of the coil is at or near a center of a spiral, while the second end of the coil is at an outer portion of the spiral. It is easy to compress the cone or truncated cone. Such a coil can have a longer stroke or course of compression than a helical cone that has a cylindrical outline with a longer stroke or course of compression; the feel of the coil is springier. This is a result of the fact that the end turn of the coil with a shorter diameter is received inside concentrically with the remaining turns. Stated differently, the coil continues to provide its spring function along a greater distance before reaching its totally compressed state at which it becomes a harder support structure.

Such a cone or truncated cone coil may be made from a slat with a thickness of 5-11 mm before processing, which after processing when finished may have a thickness of 4-11 mm. Similarly, raw width may be 16-36 mm, which after processing may be 15-35 mm. The outer diameter of the coil before it is dried, cut, sanded and glued may be 100 mm - 135 mm, while the outer diameter of the finished coil may be 96 mm - 131 mm. Helical rise may be between 3 and 30 E.

The end turns of the wooden spring with an outline in the shape of a cone or truncated cone may be glued, riveted, screwed or otherwise secured, fixed or attached together. Similarly, the end turns may be tied, or otherwise banded together. Such a cone may be made on a similar type of drying reel but such a reel could have a cone or truncated cone shape so that the coil achieves the cone or truncated cone shape. The ends may be cut and sanded/chiseled in the same way as the cylindrical coil described herein. For example, one end may be affixed to hold in place, for example, on the drying reel, while the free end of the cone is cut to size. The ends turns of the coil at one or both ends of the coil may be secured together, for example, by screwing, but other means, such as gluing, taping, riveting, nailing, or tying, may also be used instead of or in addition to screwing. Such a coil may be hand sanded/scraped/chiseled using a hand tool or a power tool, or a using a suitable table tool.

The springs are then placed in a core layer of the mattress body. For example, a natural latex core layer, or other type of core layer, such as foam, including memory foam or rubber may be used. Typically, springs may be placed such that a distance between the springs is at least 1 cm and at most 30 cm. Cone or truncated cone-shape coils may be placed into the mattress in the same manner as other coils described herein, that is, for example, holes may be drilled into the core layer or the core layer may be formed with the holes, and the coils may be then placed inside. One or both ends of the coil may then be secured to neighboring layers, such as to a stabilizing layer.

The wooden springs may be positioned in the mattress as pocket springs, each spring individually wrapped and separated from other springs or from other separated pocket springs.

As discussed, the mattress can be a bespoke mattress, designed according to the personalized needs of the customer, in terms of firmness and support of the zone of the mattress, based on expressed customer preference and/or customer size and weight, or the like.

Further, the springs may be tied together using a stiff or springy material. For example, the pocket in which the coil springs are positioned may be tied together.

In addition, portions of the mattress may have no springs but may contain other types of supportive materials, such as other types of coils, latex, memory foam, webbing or the like.

In addition, the diameter of the spring as well as the layers of the mattress above and below the core layer in which the wooden springs are located, may also be varied and designed to create a personalized mattress.

Since the wooden springs are individually manufactured, the springs that are positioned at each portion of the mattress can be more readily controlled so that the target firmness is customized. By way of contrast, metal springs tend to be more uniform because they are manufactured to be identical with each other. Thus, neighboring wooden springs, for example, neighboring pocket springs, may be varied as needed for the customization using the wooden springs of the present disclosure. Thus, theoretically, each mattress can be made individually based on the demands, preferences and needs of the end customer. In addition, rows of pocket springs may be connected together, such that each pocket is connected to adjacent pockets of the row, but the rows may be separated from one another by a separating element using foam, latex, synthetic latex, all-natural latex, organic or ergo-latex, foam, including cold foam or the like, wool, cotton, horse hair, camel hair, llama hair, coir natural fibers, or a combination of the foregoing used as a dividing layer. Typically, the rows can be glued or tied or otherwise attached to the dividing or separating elements between the rows. Such separating elements can be made of the same material or different materials may be used to divide the various rows. Latex or ergo-latex materials may be used as a dividing layer. Materials used for the dividing layers will also affect the stiffness or firmness of the mattress, and thus can be customized according to the target parameters of the mattress. Another approach is to put dividing elements between every single wooden spring and thus dividing each wooden spring of the mattress core, from each of its adjacent springs using such dividing elements. Later the mattress may be made of various known materials, including latex, foam, wool, cotton, coconut fiber, horsehair or a combination of the foregoing.

The glued and dried and sanded coil may then be waxed using one or more commercially available waxes. For example, Hartwachs produced by Remmers may be used. Such waxing may prolong the useful life of the coils. In certain regions such as tropics and other areas of high humidity, the wax will tend to protect the coils. For coils made of non-compressed wood, it may be desirable especially to use wax to prevent deformation of the shape of the coil. The coils are dipped into the hard wax. For example, the coils may be dipped for ten seconds or the like.

Also described is a mattress comprising such wooden springs, or a combination of wooden springs and other springs, such as springs made of steel or other metal and/or alloys. Wooden springs can regain their shape 100%, can have three times longer working lifespan, and, as discussed, are free of electrical and magnetic fields and electrostatic smog or noise.

The most general embodiment of the invention is described with the characteristics of the independent claims. The other claims describe the advantageous embodiments of the mattress and producing thereof.

Mattress manufactured with wooden springs made from non-compressed hard or semi-hard wood, the mattress comprising several comfort layers, at least one stabilizing layer, an outside of the mattress, and a mattress core, characterized in that the wooden springs are made from non-compressed hard or semi-hard wood, the cross-section of the wooden spring is approximately rectangular, at least one end of the wooden spring is secured to the stabilizing layer, most of the wooden springs are positioned in the middle third of the length of the mattress core for receiving a human hip region of a human body lying on the mattress.

A method of producing a mattress having wooden springs made of non-compressed wood, the mattress comprising several comfort layers and stabilizing layer and the wooden springs being fixed to the stabilizing layer, the method comprising: wrapping a slat of hard or semi-hard wood on a reel and securing the slat on the reel to form the wooden spring from the slat; steaming the wooden spring on the reel; drying the wooden spring; and shaping an end turn of the wooden spring the wrapping and securing the slat comprises securing a first end of the slat on the reel, winding the slat around the reel, and clinching the second end of the slat, the wrapping of the slat comprises positioning, as a guide reel, a second reel to guide the slat.

Figure 1 is a perspective view illustrating an example of a mattress with a mattress core including non-compressed wooden springs, according to an aspect of the present disclosure.

Figure 2 illustrates the detail of a mattress with wooden springs affixed to the comfort layer, according to an aspect of the present disclosure.

Figure 3 illustrates an example of positions of wooden springs in the mattress, according to an aspect of the present disclosure.

Figures 4-5 illustrate examples of connected pockets containing wooden coil springs, according to an aspect of the present disclosure.

Figures 6-7 illustrate examples of a wooden spring with a cone or truncated cone shape, according to an aspect of the present disclosure.

Figure 8 illustrates an example of a wooden spring with a cone or truncated cone shape in a compressed state, according to an aspect of the present disclosure.

Figure 9 illustrates an example of wooden spring having turns of increasing diameter, according to an aspect of the present disclosure.

Figures 10-12 illustrate examples of wooden springs with an end turn formed of several turns affixed or secured together, according to an aspect of the present disclosure.

Fig. 1 illustrates a mattress having a mattress core 1 that includes wooden springs 2. The wooden springs 2 are made of non-compressed wood, the type of semi-hard or hard. The wood type can be for example walnut, cherry, or other nut tree, beech and oak, and other types of semi-hard or hard woods. Furthermore, the mattress comprises a stabilizing layer 4, and several comfort layers 6, 6a and 6b may also be provided. A stabilizing layer 4 is not always necessary for every mattress. For example, in case that the wooden springs 2 are 120 mm tall, with a diameter of 80 mm, are inserted into 160 mm thick latex mattress core 1, then a stabilizing layer 4 may not be needed, since the 160 mm thick mattress core 1 will secure the wooden springs 2. The mattress has an outside of the mattress 7, and may have support elements in the mattress core 1. Inside inserts can be positioned in the wooden springs 2. The wooden springs 2 may be positioned such that only the middle third of the mattress core 1, in the longitudinal direction, receives the wooden springs 2. The wooden springs 2 may be positioned inside inserts 5 or without such inside inserts 5. The first third and the last third of the mattress core 1 in the longitudinal direction may receive support element 3 instead of or in addition to the wooden springs 2. Comfort layer 6 is shown as having perforations or scoring. Such perforations or scoring help adhere it to the mattress core 1 or to stabilizing layer 4. The upper surface of the top comfort layer 6a and/or the lower surface of the bottom comfort layer

6b may be wavy or comprise ridges. Thus, the mattress core 1, and, if provided, the stabilizing layer 4, may be secured to comfort layers 6 using these ridges. The comfort layer 6 can be made of two parts, such that the bottom comfort layer 6b is scored or is perforated while the top comfort layer 6a has a smooth outer region. The comfort layer 6, 6a and 6b, the stabilizing layer 4 and the mattress core 1 may be made of foam, latex, visco elastic foam, sponge, rubber, including synthetic rubber, polyurethane-based foam or coconut materials or fibers, wool, cotton, horse hair, or other animal hair or fur or plastic or other synthetic materials. In addition, stabilizing layer 4 may also be made of wood-based material. It will be understood that each of these layers may be made of a combination of the foregoing materials. Wooden springs 2 may be attached to stabilizing layer 4 using a glue or other types of attaching means, such as they may be sewed or various needling means. The outside of the mattress 7 shown is made of various materials, including natural materials, such as wool, cotton, or soy or bamboo-based materials.

Fig. 2 illustrates the wooden springs 2 from a closer look. In the wooden springs 2 there may be positioned inside inserts 5.

Fig. 3 shows the mattress core 1 from above, we can see the position of the support elements 3 that wooden springs 2 will be put into. Most of the wooden springs 2 are in the middle part so that the hip area of the person is supported well. Typically, the waist region of the mattress will provide more support, will be more difficult to compress, then other regions of the mattress, because of the greater weight of the average person in this zone. It will be understood that typically a heavier person will require or prefer springs that provide more resistance, that is, that are more difficult to compress or to reach the state of total compression, then a lighter person. However, different people have different comfort levels with firmer or softer support. The use of inserts of such different dimensions and different firmness provides the ability to customize readily the mattress to the individual needs and preferences. Thus, the inserts can be pre-manufactured and the inserts can be placed into the mattress for the end user without needing to totally disassemble the mattress and the springs. the user can “upgrade” to more or less firm support by exchanging one or more inserts. Also, if there is a problem with a portion of the mattress, then inserts corresponding to that portion can be exchanged, repaired or replaced.

Figs. 4-5 show that the wooden springs 2 may be positioned in the mattress in pockets 8; each wooden spring 2 individually wrapped and separated from other wooden springs 2 or from other separated pockets 8. Rows of pockets 8 may be connected together, such that each pocket 8 is connected to adjacent pockets 8 of the row, but the rows may be separated from one another by a separating element 9 using foam, latex, synthetic latex, all-natural latex, organic or ergo-latex, foam, including cold foam or the like, wool, cotton, horse hair, camel hair, llama hair, coir natural fibers, or a combination of the foregoing used as a dividing layer. Typically, the rows can be glued or tied or otherwise attached to the dividing or separating elements 9 between the rows. Such separating elements 9 can be made of the same material or different materials may be used to divide the various rows.

Figs. 6-7 show that the wooden springs 2 can have a cone-shaped or truncated cone-shaped profile. Each turn of the cone shaped wooden spring 2a has a diameter slightly smaller than the previous adjacent turn. In this way, one end of the coil is at or near a center of a spiral, while the second end of the coil is at an outer portion of the spiral.

Fig. 8 also illustrates a cone shaped wooden spring 2a. It is easy to compress the cone or truncated cone with a use of a fastener 10. The fastener 10 can mean using glue, one or more screw(s), bolt, bracket, nail and/or rivet or other fastener, including ropes and bands. Compressing the cone shaped wooden spring 2a changes the way the cone shaped wooden spring 2a works.

Fig. 9 shows the diameter of the wooden spring 2.

Figs 10-12 illustrate examples of wooden springs with an end turn formed of several turns affixed or secured together. Wooden springs 2 can have several turns at one or both of its ends, for example, between one and three “end turns” joined together, for example, using glue, one or more screw(s), bolt, bracket, nail and/or rivet or other fastener, including ropes and bands, to produce thicker end turns.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications, other combinations of features described, and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein.

CLAIMS

1. Mattress manufactured with wooden springs made from non-compressed hard or semi-hard wood, the mattress comprising several comfort layers, at least one stabilizing layer, an outside of the mattress, and a mattress core, **characterized** in that the wooden springs (2) are made from non-compressed hard or semi-hard wood, the cross-section of the wooden spring (2) is approximately rectangular, at least one end of the wooden spring (2) is secured to the stabilizing layer (4), most of the wooden springs (2) are positioned in the middle third of the length of the mattress core (1) for receiving a human hip region of a human body lying on the mattress.

2. Mattress according to claim 1, **characterized** in that the first plurality of wooden springs (2) comprises wooden springs (2) shorter than wooden springs (2) of the second plurality of wooden springs (2), and/or the first plurality of wooden springs (2) comprises wooden springs (2) each with an end turn thicker than end turns of the wooden springs (2) of the second plurality of wooden springs (2) and/or the first plurality of wooden springs (2) comprises wooden springs (2) each with a course of compression shorter than the course of compression of each of the wooden springs (2) of the second plurality of wooden springs (2).

3. Mattress according to claim 1 or 2, **characterized** in that the wooden springs (2) comprise wooden springs (2) of cylindrical shape and/or wooden springs (2) of cone (2a) or truncated cone shape.

4. Mattress according to one of the claims 1-3, **characterized** in that the wooden springs (2) comprise a wooden spring (2) having a longitudinal axis extending through a center of the wooden spring (2), and the end turn has an outer surface facing away from any adjacent turn of the wooden spring (2) and substantially perpendicular, for at least 180 degrees of the end turn, to the longitudinal axis of the wooden spring (2).

5. Mattress according to one of the claims 1-4, **characterized** in that the wooden spring (2) is formed of a slat, and a width of the slat at a first portion of the wooden spring (2) corresponding to an end turn of the wooden spring (2) is smaller than widths of the slat

corresponding to remaining turns of the wooden spring (2), the width being a dimension of the slat greater than a thickness of the slat but smaller than a length of the slat.

6. Mattress according to one of the claims 1-5, **characterized** in that the wooden spring (2) is positioned in an support element (3) which is implanted in the mattress core (1) and/or the wooden spring (2) contains an inside insert (5).

7. Mattress according to one of the claims 1-6, **characterized** in that the wooden springs (2) are positioned in pockets (8), the pockets (8) create rows and separating elements (9) are arranged between the rows.

8. Mattress according to one of the claims 1-7, **characterized** in that some of the turns of the wooden springs (2) are fixed together by a fastener (10) for regulating the hardness of the wooden springs.

9. A method of producing a mattress of claim 1 having wooden springs made of non-compressed wood, the mattress comprising several comfort layers and stabilizing layer 4 and the wooden springs (2) being fixed to the stabilizing layer (4), the method comprising: wrapping a slat of hard or semi-hard wood on a reel and securing the slat on the reel to form the wooden spring (2) from the slat; steaming the wooden spring (2) on the reel; drying the wooden spring (2); and shaping an end turn of the wooden spring (2), the wrapping and securing the slat comprises securing a first end of the slat on the reel, winding the slat around the reel, and clinching the second end of the slat, the wrapping of the slat comprises positioning, as a guide reel, a second reel to guide the slat.

10. The method of claim 9, wherein the wooden springs (2) are being glued to the stabilizing layer (4) by resin.

11. The method of claim 9 or 10, wherein the wooden spring (2) has a longitudinal axis, and the shaping of the end turn comprises: positioning a spacer at an outer major surface of the end turn, the outer major surface being transverse to the longitudinal axis, the spacer positioned substantially perpendicular to a longitudinal axis of the wooden spring (2), such that the spacer prevents movement of the wooden spring along the longitudinal axis toward the spacer; and positioning a device immediately adjacent an end of the end turn, such that the

device prevents movement of the end of the end turn in a circumferential direction with respect to the longitudinal axis.

12. The method of one of the claims 9-11, wherein creating at least three turns for the wooden spring (2), each turn having a diameter smaller than an immediately adjacent turn.

13. The method of one of the claims 9-12, wherein the shaping of the end turn comprises joining and securing together at least two turns of the wooden spring (2) to form the end turn.

14. The method of one of the claims 9-13, wherein the shaping of the end turn comprises decreasing thickness, the thickness being a shorter dimension of the slat that forms the wooden spring (2).

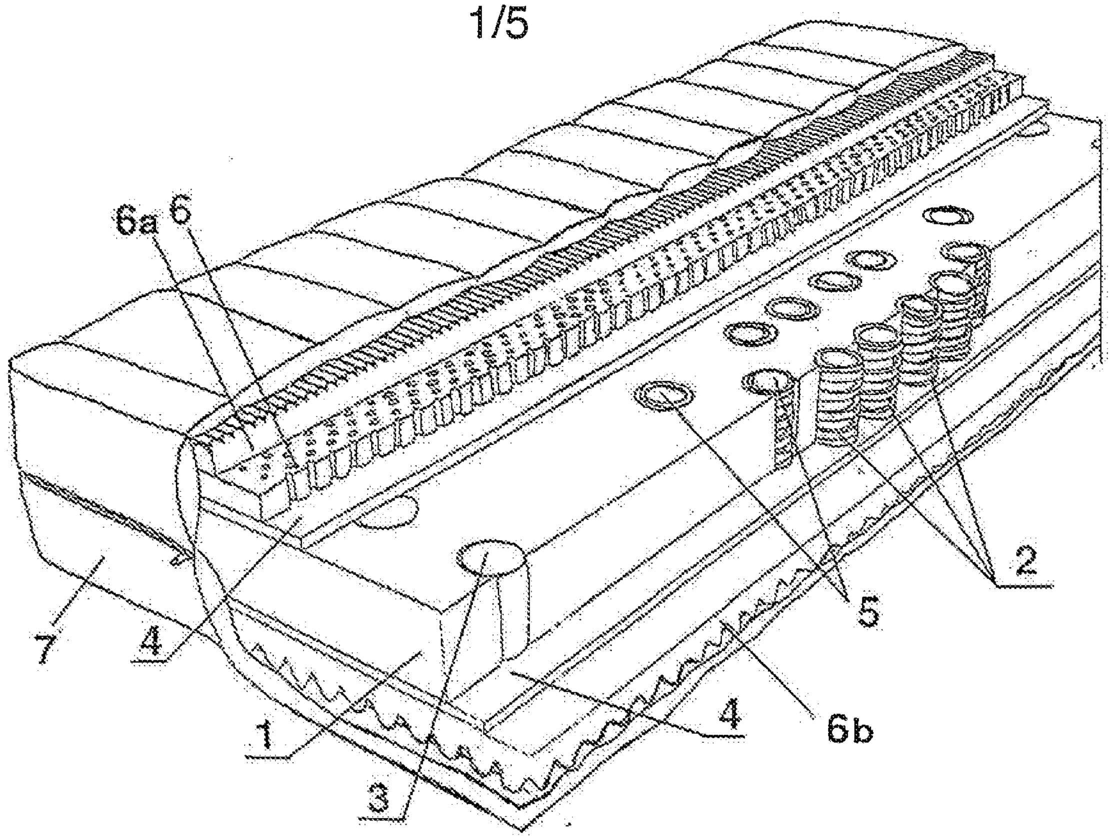


Figure 1

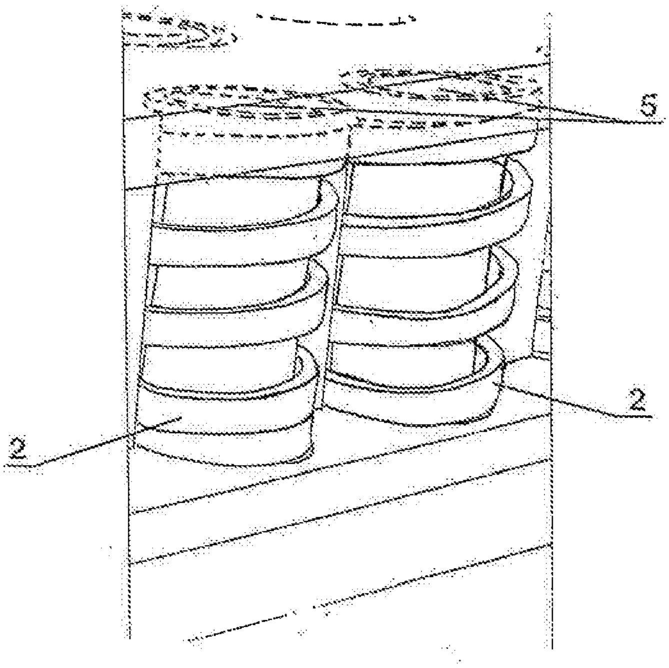


Figure 2

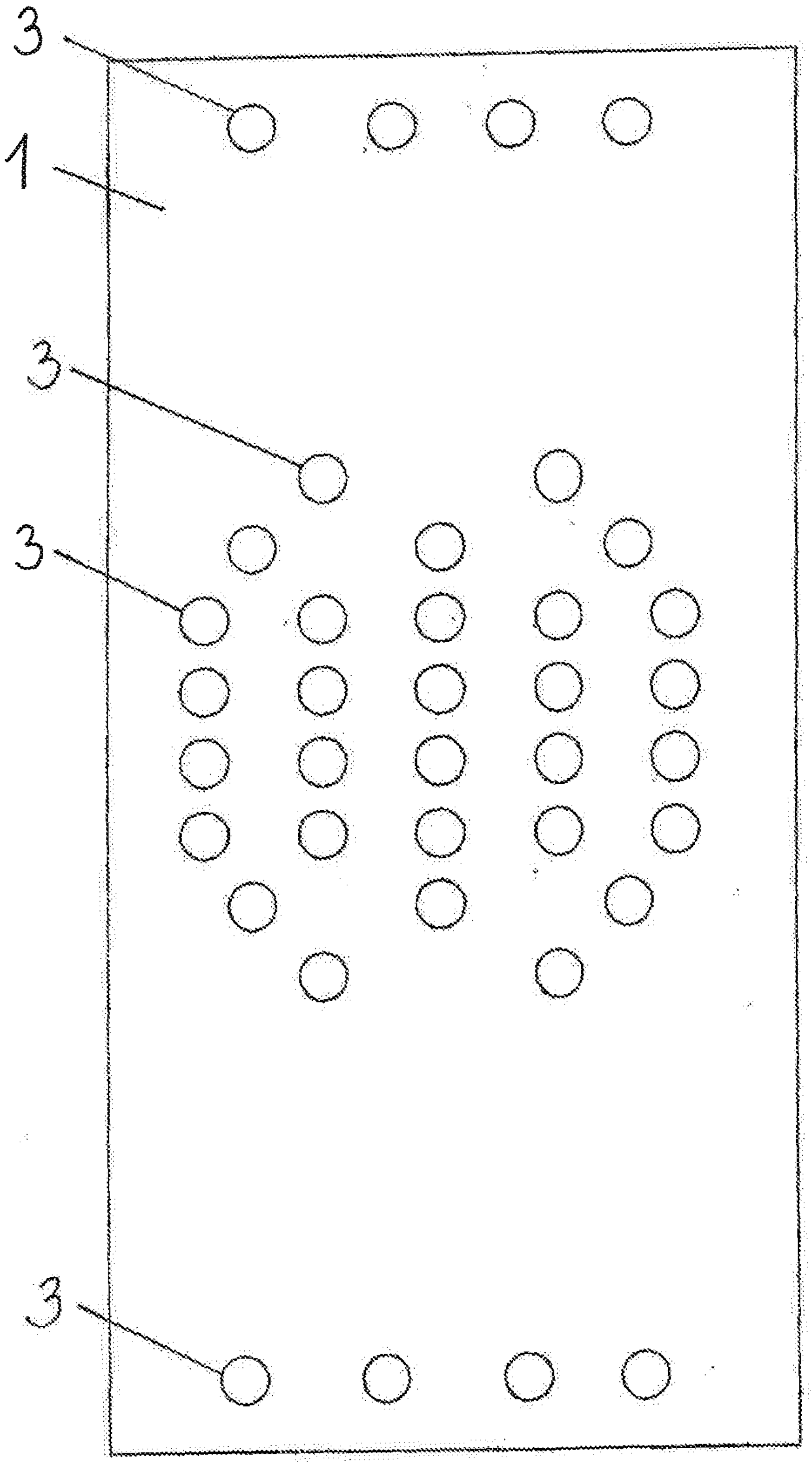
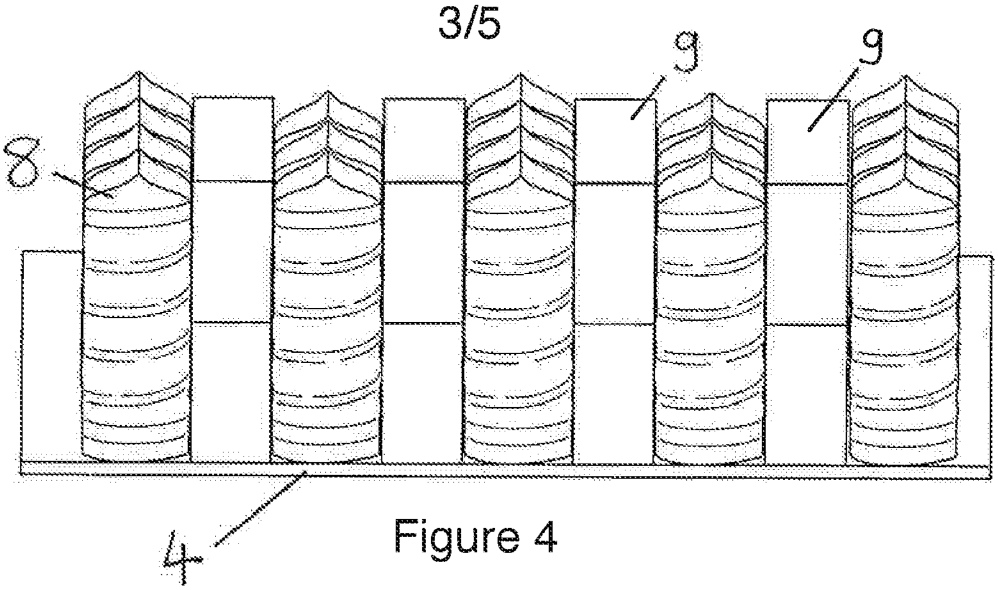


Figure 3



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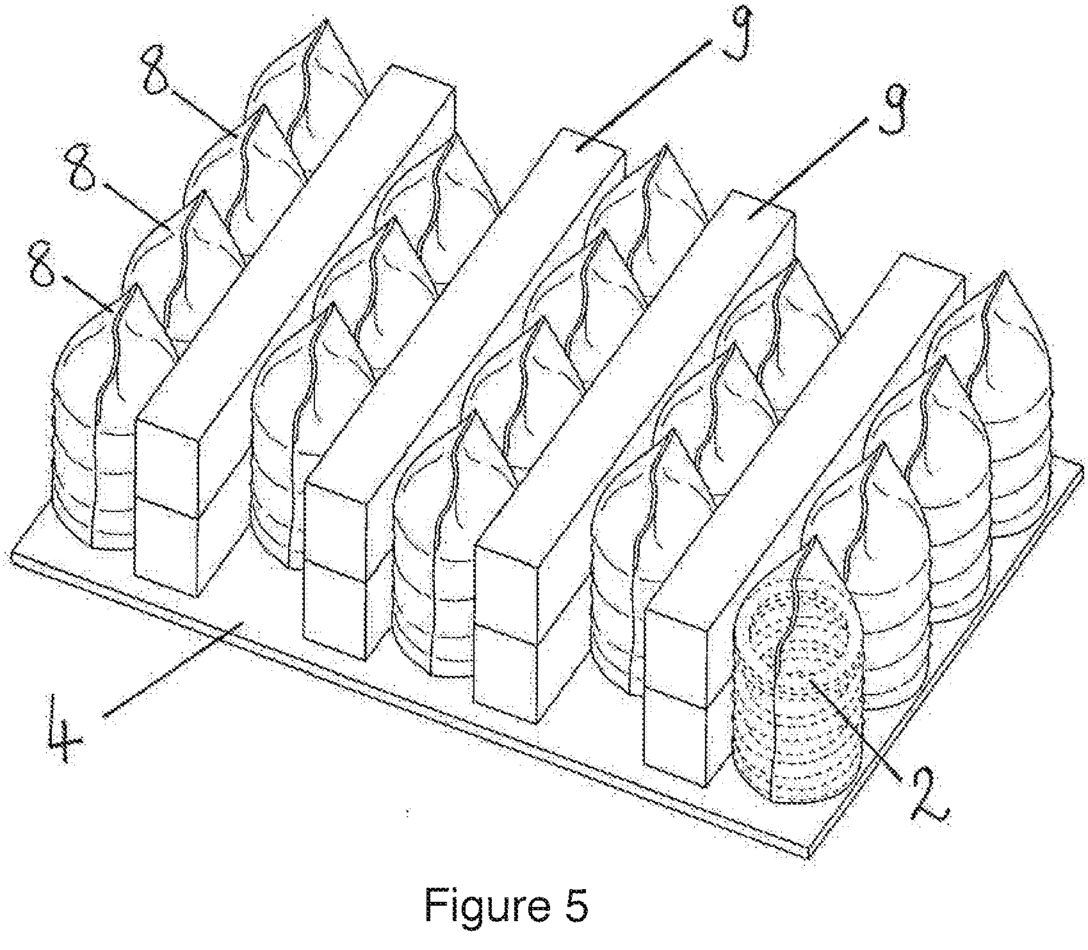

Figure 5

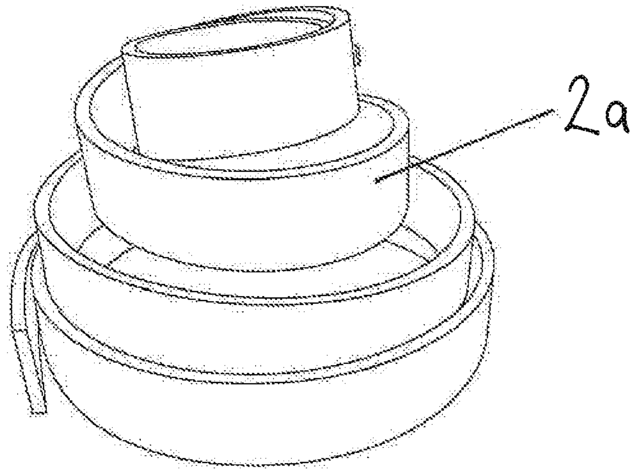

Figure 6

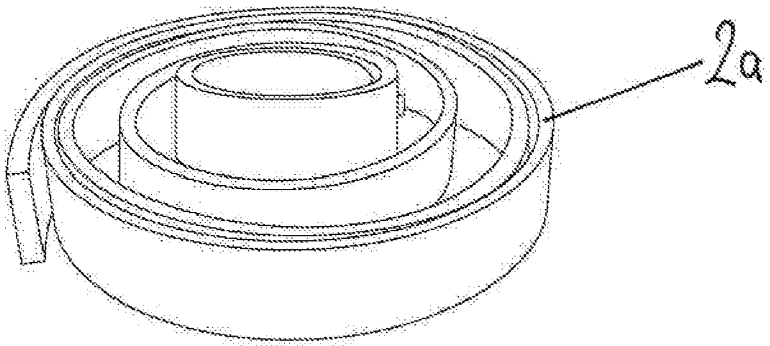

Figure 7

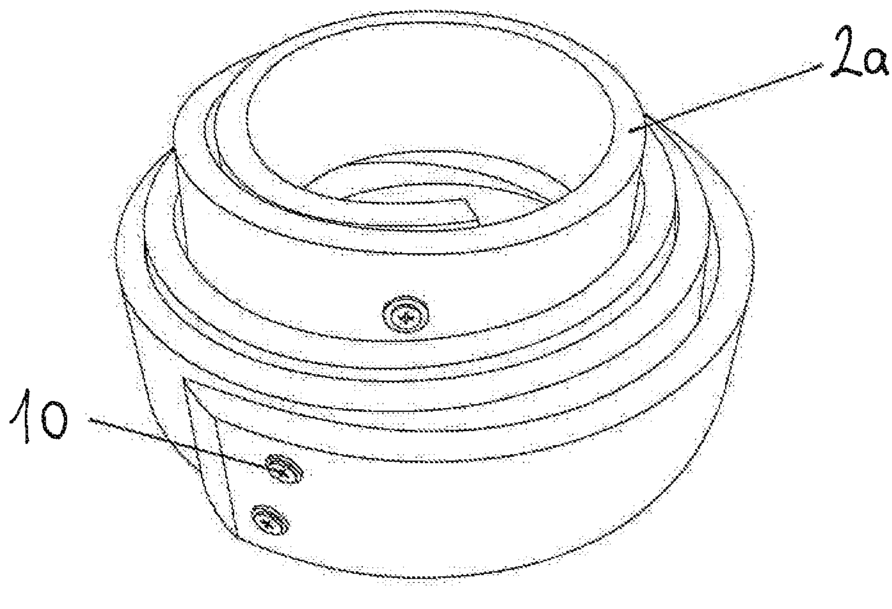

Figure 8

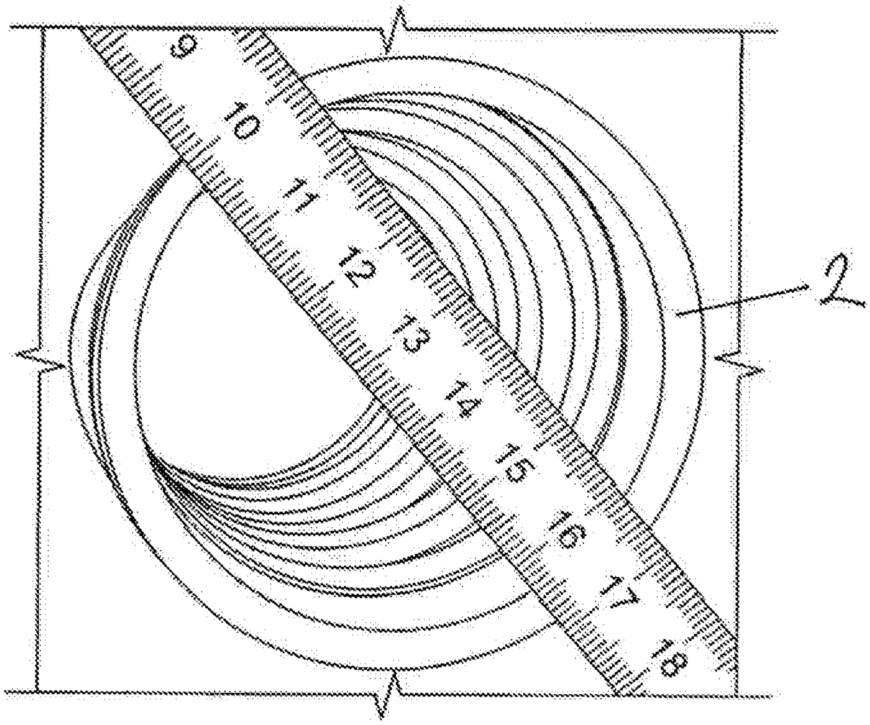

Figure 9

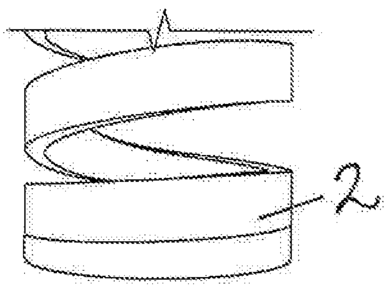

Figure 10

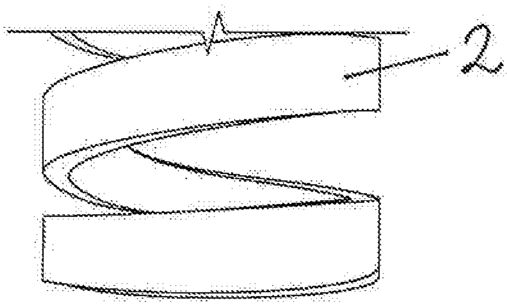

Figure 11

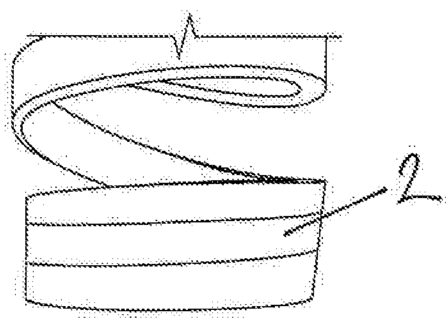

Figure 12

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference voros-pct	**FOR FURTHER ACTION** see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/IB2015/050468	International filing date *(day/month/year)* 21 January 2015 (21-01-2015)	(Earliest) Priority Date *(day/month/year)* 22 January 2014 (22-01-2014)
Applicant VOROS, GABOR		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into ______________, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. [ ] **Certain claims were found unsearchable** (See Box No. II)
3. [ ] **Unity of invention is lacking** (see Box No III)
4. With regard to the **title,**
   [ ] the text is approved as submitted by the applicant
   [X] the text has been established by this Authority to read as follows:

   MATTRESS MANUFACTURED WITH WOODEN COIL SPRINGS AND METHOD FOR PRODUCING THEREOF

5. With regard to the **abstract,**
   [ ] the text is approved as submitted by the applicant
   [X] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority
6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1
      [X] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/050468

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47C23/043 A47C27/06 F16F1/364
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47C F16F

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AT 13 165 U1 (BIO TEXTIMA KFT) 15 July 2013 (2013-07-15) abstract; figures 1,5-7 page 1, paragraphs 5,7 page 3, paragraphs 27,28 -----	1,3-6
A	EP 1 048 248 A1 (RECTICEL) 2 November 2000 (2000-11-02) cited in the application abstract; figures 1,3 page 2, paragraphs 1,3,9 -----	1

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

[X] See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 June 2015	19/06/2015

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

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Form PCT/ISA/210 (second sheet) (April 2005)

International application No
PCT/IB2015/050468

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 002 759 A1 (SZABO IMRE DR) 17 December 2008 (2008-12-17) cited in the application abstract; figures 4-6 page 2, paragraph 1 page 3, paragraph 9 page 4, paragraph 16 -----	1
A	US 5 596 777 A (POLUS MICHAEL) 28 January 1997 (1997-01-28) cited in the application abstract; figures 1,2 -----	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2015/050468

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
AT 13165	U1	15-07-2013	AT 13165	U1	15-07-2013
			BG 1649	U1	31-01-2013
			CN 202604250	U	19-12-2012
			CZ 23875	U1	06-06-2012
			DE 202011109222	U1	13-02-2012
			DK 201200007	U3	11-05-2012
			EE 01135	U1	15-01-2013
			HU 4004	U	28-10-2011
			JP 3173560	U	09-02-2012
			PT 10770	T	15-06-2012
			RU 119217	U1	20-08-2012
			SK 50012012	U1	03-07-2012
			TR 201112307	U	23-01-2012
EP 1048248	A1	02-11-2000	BE 1012631	A6	09-01-2001
			EP 1048248	A1	02-11-2000
EP 2002759	A1	17-12-2008	AT 531298	T	15-11-2011
			EP 2002759	A1	17-12-2008
US 5596777	A	28-01-1997	AT 175549	T	15-01-1999
			CA 2153616	A1	20-01-1996
			DE 9411638	U1	23-11-1995
			EP 0694272	A1	31-01-1996
			ES 2127971	T3	01-05-1999
			US 5596777	A	28-01-1997