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(54) **CUSHIONING LAYER FOR A MATTRESS ASSEMBLY AND MATTRESS ASSEMBLY**

(57) The invention relates to a cushioning layer (14) for a mattress assembly (10), wherein the cushioning layer (14) is configured to be placed on a spring core assembly (12) with at least one spring coil (34), wherein the cushioning layer (14) comprises a frame (20) made of

a foam and a thermoplastic elastomer (TPE) grid layer (22), wherein the thermoplastic elastomer grid layer (22) is surrounded by the frame (20). Further, the invention relates to a mattress assembly (10) comprising the cushioning layer (14) and a spring core assembly (12).

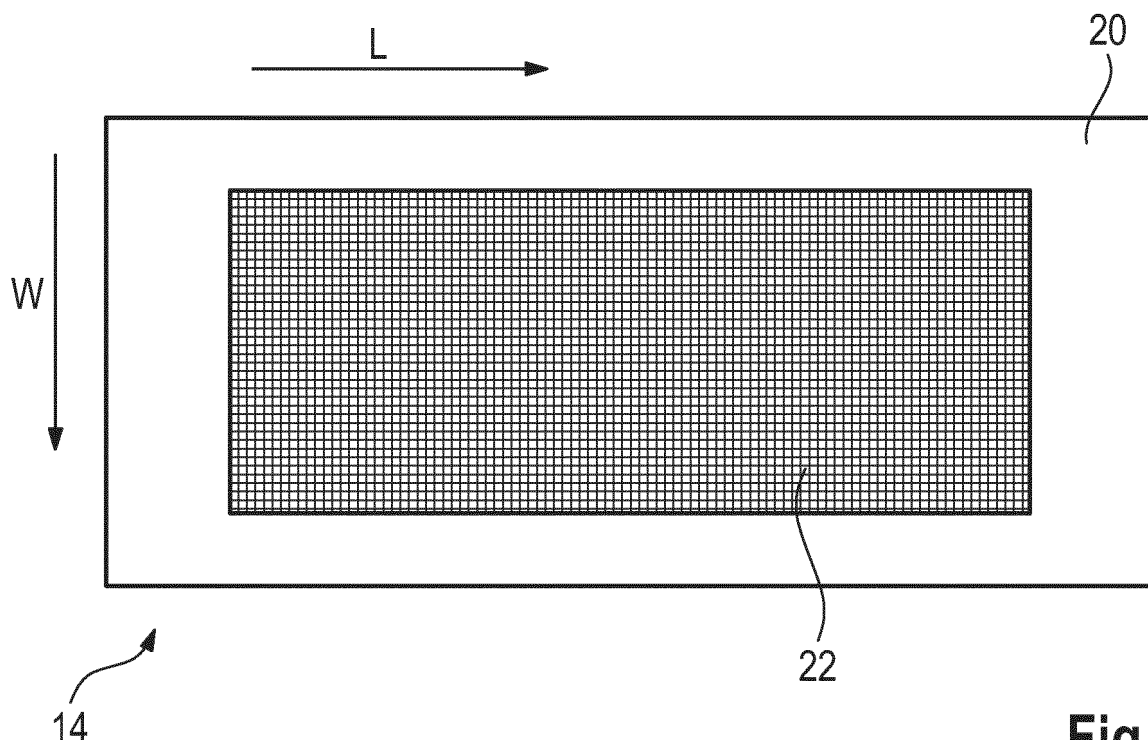


Fig. 2

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Description

[0001] The invention relates to a cushioning layer for a mattress assembly comprising a spring core assembly. Further, the invention relates to a mattress assembly.

[0002] In the state of the art, cushioning layers comprising gel inserts are known which provide a desired lying comfort for a user. Those gel inserts are usually heavy and rarely breathable such that they retain moisture, which is undesired.

[0003] Further, mattress assemblies with several different layers are known from the state of the art as well, which provide a desired comfort for a user of the mattress assembly.

[0004] Furthermore, foam mattress assemblies are known in the state of the art that consist of foam layers, wherein at least one of the foam layers provides different lying zones, also called body zones, e.g. by means of cutouts and/or recesses. For instance, the well-known Emma One Foam Mattress is a mattress assembly that consists of foam layers.

[0005] Additionally, so-called hybrid mattress assemblies are known that also comprise a spring core layer as well as at least one foam layer located on top of the spring core layer. Usually, the spring core layer comprises several spring pockets that are manufactured in the same manner. These mattress assemblies may also have different lying zones that are established by means of the additional foam layer placed on top of the spring core layer, for instance due to cutouts and/or recesses within the foam layer. Alternatively or additionally, several foam layers are provided which also provide different lying zones, e.g. by means of cutouts and/or recesses. For instance, the Emma Hybrid Mattress comprises three foam layers and one spring core layer while providing five different lying zones.

[0006] Generally, the size and/or shape of the respective cutouts and/or recesses may be varied in order to establish the different zones, e.g. zones with different hardness or rather stiffness.

[0007] Actually, the concept of providing the different lying/body zones is used since the foam layers can be manufactured in a cost-efficient manner such that it is less cost-intensive to provide foam layers having different characteristics.

[0008] However, providing cutouts and/or recesses may result in cutoffs or rather waste of material, which is disadvantageous. To overcome this disadvantage, it is already known to provide corresponding foam layers from a foam block, thereby reducing the cutoffs or rather waste of material. This concept is described in DE 10 2017 117 556 A1.

[0009] However, there is still a need for an improved mattress assembly that reduces the waste of material. Similarly, there is also still a need for an improved cushioning layer which reduces the weight of the cushioning layer and the overall mattress assembly while maintaining the user experience, namely the lying comfort.

[0010] The invention provides a cushioning layer for a mattress assembly. The cushioning layer is configured to be placed on a spring core assembly with at least one spring coil. The cushioning layer comprises a frame made of a foam and a thermoplastic elastomer (TPE) grid layer, namely a layer having a grid structure while being made from a thermoplastic elastomer (TPE). The thermoplastic elastomer grid layer is surrounded by the frame. In other words, the thermoplastic elastomer grid layer only makes up a partial area of the entire cushioning layer. The rest of the area is provided by the frame made of foam.

[0011] Accordingly, the cushioning layer according to the invention ensures that the thermoplastic elastomer grid layer is substantially supported due to its material and structure as well as the frame surrendering the thermoplastic elastomer grid layer. By using a thermoplastic elastomer material instead of a gel material as well as by using the respective grid structure, the weight of the cushioning layer can be reduced compared to solid layers made of a gel material.

[0012] Furthermore, the thermoplastic elastomer grid layer is essential in providing an improved breathability and reducing the amount of moisture that is retained. Therefore, using a thermoplastic elastomer grid layer in the cushioning layer improves the overall user experience.

[0013] In particular, through the differing breathability of the thermoplastic elastomer grid layer and of the foam frame different cooling characteristics are obtained. In fact, the combination of the thermoplastic elastomer grid layer and the foam frame provide more cooling for the main body compared to the extremities, as the thermoplastic elastomer grid layer is associated with the main body.

[0014] In addition, the thermoplastic elastomer grid layer ensures that the entire cushioning layer is foldable and/or rollable. Accordingly, the cushioning layer can be brought into a shipping state in an easy manner, e.g. a rolled-up state, in which the thermoplastic elastomer grid layer is stowed in a shipping bag.

[0015] Specifically, it is possible to fold and (afterwards) roll the entire cushioning layer. This can be achieved due to the combination of the thermoplastic elastomer grid layer and the frame, particularly their respective characteristics. Consequently, the mattress is easier to transport and can be stored more efficiently.

[0016] The frame surrenders the thermoplastic elastomer grid layer while simultaneously providing sufficient support, as the frame is completely made of the foam (solid matter), whereas the thermoplastic elastomer grid layer comprises voids filled with air. Hence, the frame does not comprise voids that are introduced additionally. In other words, the frame made of foam only comprises inherent air inclusions which are associated with the foam material.

[0017] Actually, the cushioning layer has two opposite main surfaces as well as four side surfaces. Each of the

main surfaces are established by a respective surface of the frame and a respective surface of the thermoplastic elastomer grid layer. In contrast thereto, the side surfaces are only built by the frame, namely the foam material of the frame.

[0018] Generally, the frame and the thermoplastic elastomer grid layer are connected with each other in a permanent manner, thereby ensuring that the entire cushioning layer is a single layer. For instance, the permanent connection between the frame and the thermoplastic elastomer grid layer is established by a welding and/or a chemical connection.

[0019] Accordingly, the cushioning layer according to the invention distinguishes from assemblies that comprise a frame with a receptacle and an insert placed in the receptacle. However, the frame and the insert are separately formed and, if at all, connected with each other in an assembled state, but not permanently.

[0020] Moreover, the frame and the thermoplastic elastomer grid layer each have a geometric centre, wherein the geometric centres coincide.

[0021] An aspect of the invention provides that the thermoplastic elastomer grid layer has a hardness that is higher compared to the hardness of the frame, particularly by 10% to 20%, and has a minimum netto density that is higher than the minimum netto density of the frame, particularly by a factor of 5 to 10, preferably by a factor of 6 to 8. This ratio ensures optimized characteristic with regard to the support, the handling and the cushioning, i.e. hardness and/or stiffness. Even though the thermoplastic elastomer grid layer has a higher hardness than the frame as well a higher minimum netto density than the frame, the thermoplastic elastomer grid layer provides a softer feeling to a user with regard to the lying comfort compared with the frame. This is ensured due to the structure of the thermoplastic elastomer grid layer that has the lattice structure, namely the voids filled with air, rather than a solid material.

[0022] Particularly, the thermoplastic elastomer grid layer has a minimum netto density of 230 kg/m³ and/or a hardness of 2.8 kPa. These characteristics together with the structure of the thermoplastic elastomer grid layer, namely the voids, ensure that the desired lying comfort is obtained.

[0023] Furthermore, the thermoplastic elastomer grid layer makes up between 40% and 70%, preferably 50%, of the cushioning layer. That way the average area, the user would sleep on is covered by the thermoplastic elastomer grid layer, meaning the user experience is not compromised. Consequently, the size of the thermoplastic elastomer grid layer depends on the overall size of the cushioning layer, which in turn depends on the mattress size. However, by not having the thermoplastic elastomer grid layer make up the whole area of the cushioning layer, the handling and the lying comfort of the cushioning layer can be improved.

[0024] Another aspect of the invention provides that the foam is a hypersoft foam having a minimum netto

density of 32 kg/m³ and/or a hardness of 2.5 kPa. These characteristics ensure that the desired lying comfort is obtained. In contrast to the thermoplastic elastomer grid layer, the frame is made completely of the foam, namely in a solid manner. Accordingly, the minimum netto density and the hardness of the thermoplastic elastomer grid layer are higher compared to the frame due to the fact that the thermoplastic elastomer grid layer is structured differently, as it comprises the voids.

[0025] The thermoplastic elastomer grid layer has several walls intersecting each other, thereby defining voids, wherein the thermoplastic elastomer grid layer comprises equally or differently sized voids. By comprising differently sized voids, the thermoplastic elastomer grid layer can provide different lying/body zones, improving the user experience, namely by providing the preferred support for each lying/body zone, for instance for the hip, the shoulder and other body parts having different requirements. Actually, different lying/body zones with different characteristics may be provided by means of the differently sized voids.

[0026] Generally, the voids, irrespective of their size, are established by the walls intersecting each other, thereby defining the voids. Furthermore, the voids allow the cushioning layer to be foldable since there is room for the material of the walls to extend into when the cushioning layer is folded even though the cushioning layer is made by the TPE material having the characteristics outlined above.

[0027] Preferably, the thermoplastic elastomer grid layer comprises supporting areas in which the voids have a smaller size compared to voids located in other areas of the thermoplastic elastomer grid layer. This ensures optimal comfort and different support for the different body zones, leading to an improved user experience.

[0028] The voids may have different shapes, particularly rectangular shape, hexagonal shape and/or honeycomb shape. For instance, the rectangular shape relates to squares. These forms generally provide different stability which however (also) depends on the size of the voids, namely the distances of opposing walls which limit the respective voids. Furthermore, they are relatively easy to produce and therefore do not add to the production costs in a significant manner.

[0029] Further, the invention provides a mattress assembly. The mattress assembly comprises a cushioning layer and a spring core assembly, wherein the spring core assembly comprises at least one spring pocket that has a bottom fabric, a top fabric as well as at least one spring coil located between the bottom fabric and the top fabric. A grammage of the bottom fabric is different to a grammage of the top fabric.

[0030] Accordingly, the spring core assembly that may be used as a spring core layer within the mattress assembly comprises spring pockets with different fabrics above and beneath the respective spring coils. This ensures that the spring core assembly, particularly the respective spring coil, has an improved support.

[0031] For instance, the bottom fabric and the top fabric are polypropylene (PP) fabrics, e.g. textile products that are derived from the thermoplastic polymer polypropylene.

[0032] The spring core assembly has several spring pockets, for instance 448 spring pockets (90 cm x 190 cm) or rather 462 spring pockets (90 cm x 200 cm). Depending on the width of the spring core assembly, a different number of spring pockets may be provided.

[0033] Generally, the bottom fabric and the top fabric are located on opposite sides of the respective spring pocket(s).

[0034] For instance, the spring core assembly has a height of 195 mm.

[0035] An aspect provides that the grammage of the bottom fabric is higher than the grammage of the top fabric. Therefore, the support of the spring coils is ensured due to the higher grammage of the bottom fabric. Actually, the spring core assembly, namely the spring core layer, may relate to a bottom layer of the mattress assembly such that the higher grammage of the bottom fabric also ensures that the mattress assembly can be placed on a frame of a bed via the spring core assembly, namely the bottom fabric, thereby providing sufficient support and sufficient durability.

[0036] For instance, a ratio of the grammage of the top fabric to the grammage of the bottom fabric is between 0.375 and 0.8, preferably 0.4 and 0.6, particularly 0.5. This ratio ensures optimized characteristic with regard to the (mechanical) support and the mattress characteristics, e.g. hardness and/or stiffness.

[0037] Particularly, the grammage of the top fabric is between 60 g/m² and 80 g/m², for instance 65 g/m². Alternatively or additionally, the grammage of the bottom fabric is between 100 g/m² and 160 g/m², for instance 130 g/m². These specific grammages ensure that the spring coils are supported in a defined manner while simultaneously providing enough support by means of the spring core assembly due to the high grammage of the bottom fabric.

[0038] Another aspect provides that the spring core assembly comprises a first type spring pocket and a second type spring pocket. Both types of spring pockets have the same bottom fabric and the same top fabric. The grammage of the bottom fabric is different to the grammage of the top fabric. The first type spring pocket has a first spring coil that is located between the bottom fabric and the top fabric. The second type spring pocket has a second spring coil that is located between the bottom fabric and the top fabric. The first spring coil and the second spring coil are different. For instance, the first spring coil and the second spring coil have different characteristics with regard to stiffness.

[0039] The different types of the spring pocket, namely the first type spring pocket and the second type spring pocket, ensure that different lying/body zones can be provided by the spring core assembly, causing different zones in the entire mattress assembly.

[0040] The first type spring pocket and the second type spring pocket may be neighbored and glued to each other. This ensures that the different types of spring pockets can be connected with each other even though they have different characteristics with regard to stiffness due to their different spring coils. Since the spring pockets are glued with each other, their relative positions are fixed.

[0041] The first spring coil and the second spring coil may have different diameters. Particularly, the diameter of the first spring coil is smaller than the diameter of the second spring coil. The different diameters of the spring coils provide a different hardness or rather stiffness. Therefore, different lying/body zones can be obtained that comprise either the first type spring pocket or the second type spring pocket.

[0042] The ratio of the diameter of the first spring coil to the diameter of the second spring coil may be between 0.72 and 0.95, particularly 0.9. This ratio ensures that a user may recognize a different lying/body zone, but still has a good feeling since no big differences between the respective hardness of the spring coils are provided.

[0043] For instance, the diameter of the first spring coil is between 1.6 mm and 1.9 mm, particularly 1.8 mm. Alternatively or additionally, the diameter of the second spring coil is between 1.8 mm and 2.2 mm, particularly 2 mm. These diameters ensure a sufficient hardness and stability of the individual spring coils while simultaneously providing the desired comfort of the lying/body zones.

[0044] A further aspect provides that several first type spring pockets are connected in series, particularly by welding, thereby forming a line of first type spring pockets. Alternatively or additionally, several second type spring pockets are connected in series, particularly by welding, thereby forming a line of second type spring pockets. Depending on the size, particularly width, of the spring core assembly, the respective line may comprise a different number of spring pockets connected with each other by welding, thereby providing the line of first type spring pockets or rather the line of second type spring pockets. Hence, the respective lines may be associated with the width of the spring coil assembly or rather the mattress assembly. Accordingly, the same type of spring pockets is used along a width dimension of the spring coil assembly or rather the mattress assembly.

[0045] Moreover, at least two lines of first type spring pockets are located next to each other, wherein the spring pockets of neighbored lines are glued to each other. Alternatively or additionally, at least two lines of second type spring pockets are located next to each other, wherein the spring pockets of neighbored lines are glued to each other. A respective zone of spring pockets of the same type may be established by providing two or more lines of the same type pocket springs. However, a certain zone may also be realized by only a single line, particularly a single line of the first type spring pockets. Zones established by the second type spring pockets may always comprise at least two lines of second type spring

pockets.

[0046] Generally, adjacent lines of spring pockets, particularly irrespective of their type, may also be glued with each other, thereby establishing the spring core assembly.

[0047] The pocket springs of the adjacent lines may be glued to each other, whereas the pocket springs of the same line may be welded with each other.

[0048] Generally, the spring core assembly may be symmetrical with respect to two symmetrical lines intersecting each other in a center of the spring core assembly. Particularly, the symmetrical lines are perpendicular to each other. Thus, the spring core assembly has a symmetric design, thereby ensuring that the same spring core assembly could be used in two different directions, namely turned by 180° about its center in a plane, e.g. without flipping the spring core assembly. In other words, the spring core assembly does not have an upper edge or a lower edge since opposing edges can be interchanged. Put differently, the bottom fabric is always orientated towards the floor, e.g. the frame of a bed when used.

[0049] An aspect provides that the mattress assembly is a stack assembly that comprises the spring core assembly, a cushioning layer, at least two additional layers, wherein the at least two additional layers are positioned between the spring core assembly and the cushioning layer, and made by different materials, particularly different foams. Therefore, the mattress assembly has at least four different layers, particularly five different layers, that are stacked on each other, thereby providing the mattress assembly stack. The different layers, namely the spring core assembly, a first additional layer, a second additional layer as well as a third additional layer, each have different characteristics, e.g. a different minimum netto density and/or a different hardness. Moreover, the different (additional) layers may be manufactured by different materials, for instance different foams.

[0050] Generally, the hardness may be measured according to ISO 3386.

[0051] In a specific embodiment, the spring core assembly is a bottom layer of the mattress assembly, wherein a first additional layer is placed on the spring core assembly. A second additional layer is glued to the first additional layer. A third additional layer is glued to the second additional layer. The cushioning layer is glued to the third additional layer. All (additional) layers have different characteristics, for instance a different minimum density and/or a different hardness. Moreover, different kinds of adhesives may be used to adhere the respective layers among each other. As indicated above, a water based adhesive may be used in order to connect the first additional layer with the second additional layer. The second additional layer is connected to the third additional layer by means of a water based adhesive. In addition, the cushioning layer is connected to the third additional layer by means of a water based adhesive.

[0052] However, different adhesives may be used, e.g. a water based adhesive and/or a hot melt adhesive.

[0053] Generally, the foams used for the additional layers may relate to a polyurethane (PU), also called comfort foam, a visco memory foam and/or a hypersoft foam.

5 **[0054]** A polyurethane (PU) foam, also called comfort foam, is associated with the first additional layer that is directly placed on the spring core assembly. For instance, the first additional layer has a minimum netto density of 30 kg/m³ and/or a hardness of 3 kPa. Alternatively, the
10 first additional layer has a minimum netto density of 31 kg/m³ and/or a hardness of 2.8 kPa

[0055] The second additional layer may be made by a comfort foam or rather a visco memory foam. For instance, the second additional layer has a minimum netto density of 50 kg/m³ and/or a hardness of 1.8 kPa. Alternatively, the second additional layer has a minimum netto density of 34 kg/m³ and/or a hardness of 2.5 kPa.

[0056] The third additional layer may be made by a visco memory foam or rather a hypersoft foam. For instance, the third additional layer has a minimum netto density of 32 kg/m³ and/or a hardness of 1.5 kPa. Alternatively, the third additional layer has a minimum netto density of 40 kg/m³ and/or a hardness of 1.6 kPa.

[0057] The top layer is provided by the cushioning layer consisting of the thermoplastic elastomer grid layer surrounded by the frame made out of foam, preferably hypersoft foam.

[0058] In general, the spring core assembly and the mattress assembly may have a length of 2 m or 1.9 m such that 33 or rather 32 lines of spring pockets are used, respectively. All of the lines may be established by the two different types of spring pockets, particularly lines of spring pockets.

[0059] In a certain embodiment, e.g. a width of 90 cm, the spring core assembly comprises 14 spring pockets per line that are welded together. However, the number of spring pockets per line depends on the width of the spring core assembly or rather the mattress assembly. Accordingly, a spring core assembly or rather a mattress assembly with a width of more than 90 cm may comprise more than 14 spring pockets per line.

[0060] A first embodiment of the spring core assembly may comprise eleven zones.

[0061] In fact, a first zone that starts from a first edge may comprise two lines of a certain type of spring pockets, for instance the second type spring pockets. A second zone adjoins the first zone, which comprises six lines of a certain type of spring pockets, for instance the first type spring pockets. A third zone adjoins the second zone, which comprises five lines of a certain type of spring pockets, for instance the second type spring pockets. A fourth zone adjoins the third zone, which only comprises one single line of a certain type of spring pockets, for instance the first type spring pockets. A fifth zone adjoins the fourth zone, which comprises two lines of a certain type of spring pockets, for instance the second type spring pockets. A sixth zone adjoins the fifth zone, which only comprises one single line of a certain

type of spring pockets, for instance the first type spring pockets. A seventh zone adjoins the sixth zone, which comprises two lines of a certain type of spring pockets, for instance the second type spring pockets. An eighth zone adjoins the seventh zone, which only comprises one single line of a certain type of spring pockets, for instance the first type spring pockets. A ninth zone adjoins the eighth zone, which comprises five lines of a certain type of spring pockets, for instance the second type spring pockets. A tenth zone adjoins the ninth zone, which comprises six lines of a certain type of spring pockets, for instance the first type spring pockets. An eleventh zone adjoins the tenth zone, which comprises two lines of a certain type of spring pockets, for instance the second type spring pockets. The eleventh zone ends at a second edge that is opposite to the first edge.

[0062] A symmetrical line of the spring core assembly runs along the sixth zone, e.g. along the single line provided by the sixth zone. Another symmetrical line runs perpendicularly thereto while intersecting all zones, e.g. all lines. Both symmetrical lines intersect each other in the middle/center of the spring core assembly.

[0063] A second embodiment of the spring core assembly may comprise nine zones.

[0064] In fact, a first zone that starts from a first edge may comprise two lines of a certain type of spring pockets, for instance the second type spring pockets. A second zone adjoins the first zone, which comprises six lines of a certain type of spring pockets, for instance the first type spring pockets. A third zone adjoins the second zone, which comprises six lines of a certain type of spring pockets, for instance the second type spring pockets. A fourth zone adjoins the third zone, which only comprises one single line of a certain type of spring pockets, for instance the first type spring pockets. A fifth zone adjoins the fourth zone, which comprises two lines of a certain type of spring pockets, for instance the second type spring pockets. A sixth zone adjoins the fifth zone, which only comprises one single line of a certain type of spring pockets, for instance the first type spring pockets. A seventh zone adjoins the sixth zone, which comprises six lines of a certain type of spring pockets, for instance the second type spring pockets. An eighth zone adjoins the seventh zone, which comprises six lines of a certain type of spring pockets, for instance the first type spring pockets. A ninth zone adjoins the eighth zone, which comprises two lines of a certain type of spring pockets, for instance the second type spring pockets. The ninth zone ends at a second edge that is opposite to the first edge.

[0065] A symmetrical line of the spring core assembly runs along the fifth zone, e.g. between the two lines provided by the fifth zone. Another symmetrical line runs perpendicularly thereto while intersecting all zones, e.g. all lines. Both symmetrical lines intersect each other in the middle/center of the spring core assembly.

[0066] The different zones are used to support a user differently when the user lies on the mattress assembly.

[0067] In general, the distribution of different spring coils, particularly spring coils with different diameters, ensures zoning the spring core assembly or rather the mattress assembly. The zoning refers to provide support and relief to different areas of body. In fact, different zones of the body are head, shoulder, lumbar, pelvic, thigh, calf and foot. The spring core assembly provides adequate support and comfort for people of different body types irrespective of their sleeping position.

[0068] The additional layers, namely the foam layers, in the combination of the mattress assembly ensure pressure relief and comfort and make the mattress assembly more durable.

[0069] Generally, the additional layers, namely the foam layers, are made without cutouts and/or recesses, e.g. as full material layers.

[0070] The additional layers may have the same height, e.g. 15 mm.

[0071] The spring core assembly may have a height of about 200 mm, particularly 195 mm.

[0072] The cushioning layer may also have the height of the additional layers, e.g. 15 mm.

[0073] The entire mattress assembly may have a height of 260 mm.

[0074] Particularly, the entire mattress assembly is foldable and rollable such that the mattress assembly has a shipping state in which the cushioning layer and the spring core assembly are folded at least once and rolled up. As mentioned before, the cushioning layer is foldable and rollable such that the cushioning layer can be brought into the shipping state. Even though the spring core assembly is made edge-to-edge, e.g. without any surrounding foam, it is possible to fold and roll the spring core assembly. Consequently, the entire mattress assembly, comprising the cushioning layer and the spring core assembly, can be folded and rolled. Put differently, the cushioning layer is placed on the spring core assembly when the entire mattress assembly is folded and rolled up.

[0075] The foregoing aspects and manner of the attended advantages of the claimed subject matter will become more readily appreciated as the same become better understood by reference to the following description, when taken in conjunction with the accompanying drawings. In the drawings,

- Figure 1 schematically shows an overview of a mattress assembly according to a first embodiment of the invention that uses a spring core assembly according to a first embodiment of the invention,
- Figure 2 schematically shows an overview of a cushioning layer that may be used with any of the perceiving embodiments, wherein the cushioning layer comprises a thermoplastic elastomer grid layer and a foam frame,
- Figure 3 shows examples of a thermoplastic elastomer

mer grid layer, wherein Figure 3A shows rectangular voids and Figure 3B shows triangular voids,

- Figure 4 schematically shows an overview of a mattress assembly according to a second embodiment of the invention that uses a spring core assembly according to a second embodiment of the invention,
- Figure 5 schematically shows an overview of a mattress assembly according to a third embodiment of the invention that uses a spring core assembly according to a third embodiment of the invention, and
- Figure 6 schematically shows an overview of a mattress assembly according to a fourth embodiment of the invention that uses a spring core assembly according to a fourth embodiment of the invention.

[0076] In Figure 1, a mattress assembly 10 is shown that comprises a spring core assembly 12, a top view of which is also illustrated in Figure 1. As shown in the overview of the mattress assembly 10, the spring core assembly 12 corresponds to the bottom layer of the mattress assembly 10.

[0077] In addition, the mattress assembly 10 comprises a cushioning layer 14 that corresponds to a top layer of the mattress assembly 10.

[0078] Between the cushioning layer 14 and the spring core assembly 12, the mattress assembly 10 further comprises a first additional layer 16, a second additional layer 17 as well as a third additional layer 18.

[0079] Therefore, the mattress assembly 10 relates to a stack assembly, as different layers 12 to 18 are stacked on top of each other in order to establish the mattress assembly stack.

[0080] In contrast to the spring core assembly 12, the additional layers 16 to 18 are made of a foam.

[0081] The cushioning layer 14, shown in Figure 2 in more detail, comprises a frame 20 made of a foam and a thermoplastic elastomer (TPE) grid layer 22. The exact size of the TPE grid layer 22 depends on the overall size of the mattress assembly 10, meaning that the foam frame 20 will be selected based on the size of the TPE grid layer 22.

[0082] The TPE grid layer 22 is placed in the center of the cushioning layer 14 such that geometrical centers of the frame 20 and the TPE grid layer 22 coincide. Actually, the center region of a user lying on top of the mattress assembly 10 is supported by the TPE grid layer 22.

[0083] This ensures that the cushioning layer 14 has different cooling characteristics.

[0084] Actually, the differing breathability of the thermoplastic elastomer grid layer 22 and of the foam frame 20 provide the different cooling characteristics. In fact, the thermoplastic elastomer grid layer 22 is associated with a main body in order to provide more cooling compare to the foam frame that is associated with the ex-

trемities of a user lying on the cushioning layer 14.

[0085] In the following, example sizes and weights for standard European and British mattresses are discussed in more detail. However, the exact values are subject to change depending on which country the mattress is intended for.

[0086] For a 90 cm by 200 cm mattress, the TPE grid layer 22 has a width of 60 cm and a length of 150 cm leading to a weight of the TPE grid layer 22 of 3.2 kg.

[0087] For a 80 cm by 200 cm mattress, the TPE grid layer 22 may also have a width of 60 cm and a length of 150 cm leading to a weight of the TPE grid layer 22 of 3.2 kg.

[0088] In case of a 140 cm by 200 cm mattress, the TPE grid layer 22 has a width of 110 cm and a length of 150 cm leading to a weight of the TPE grid layer 22 of 5.9 kg.

[0089] For a 140 cm by 190 cm mattress, the TPE grid layer 22 has a width of 110 cm and a length of 140 cm leading to a weight of the TPE grid layer 22 of 5.5 kg.

[0090] In case of a 160 cm by 200 cm mattress, the TPE grid layer 22 has a width of 130 cm and a length of 150 cm leading to a weight of the TPE grid layer 22 of 7.0 kg.

[0091] In case of a 180 cm by 200 cm mattress, the TPE grid layer 22 has a width of 150 cm and a length of 150 cm leading to a weight of the TPE grid layer 22 of 8.0 kg.

[0092] Depending on the size of the cushioning layer 14, the thermoplastic elastomer grid layer 22 makes up between 40 % and 70 % of the cushioning layer 14. Hence, the foam frame 20 has a size that corresponds to 30 % to 60 % of the cushioning layer 14, which also depends on the respective size of the cushioning layer 14.

[0093] As inter alia shown in Figures 3a and 3b, the TPE grid layer 22 has several walls 24 that intersect each other and, hence, define voids 26 between them. The voids 26 are free of material, e.g. filled with air. Hence, the TPE grid layer 22 has a lattice structure due to the walls 24 and the voids 26, wherein the open sides of the voids 26 face upwards. Accordingly, the TPE grid layer 22 has a continuous base 27 via which the TPE grid layer 22 is located on top of the respective additional layer, e.g. the third additional layer 18. The several walls 24 may extend from the continuous base 27 in a perpendicular direction upwardly.

[0094] The voids 26 can have any shape. For instance, the voids 26 are rectangular, hexagonal and/or shaped like honeycombs. These forms provide sufficient, but different support, whilst providing the desired comfort for the user. Moreover, these different shapes can be realized in a cost-efficient manner.

[0095] In the shown embodiment of Figure 3b, the voids 26 have a honeycomb shape. In contrast thereto, the voids 26 of the embodiment shown in Figure 2 relate to squares. Thus, they have a rectangular shape.

[0096] Generally, the voids 26 may be equally sized as shown in Figures 2 and 3b or rather differently sized as indicated in the embodiment shown in Figure 3a.

[0097] The differently sized voids 26 may establish

different supporting areas such that a harder or rather a softer support is provided.

[0098] The TPE grid layer 22, namely the TPE material, has a density of at least 230 kg/m^3 and/or a hardness of 2.8 kPa.

[0099] Contrarily, the hypersoft foam making up the frame 20 of the cushioning layer 14, which surrenders the TPE grid layer 22, has a minimum netto density of 32 kg/m^3 and/or a hardness of 2.5 kPa. However, the frame 20 is solid, whereas the TPE grid layer 22 comprises additionally introduced voids 26.

[0100] Accordingly, the thermoplastic elastomer (TPE) grid layer 22 has a hardness that is higher compared to the hardness of the frame 20, particularly by 10 % to 20 %.

[0101] Further, the thermoplastic elastomer (TPE) grid layer 22 has a minimum netto density that is higher than the minimum netto density of the frame 20, particularly by a factor of 5 to 10, preferably by a factor of 6 to 8.

[0102] In particular, the frame 20 is only defined by sidewalls, meaning the frame 20 does not have a continuous bottom.

[0103] Particularly, the different layers 14-18 are interconnected with each other by means of an adhesive. Depending on the types of layers to be interconnected, a different adhesive may be used. Preferably water based glue/adhesive is used. However, it is possible to use hot glue, heat fusing, stitching, etc. as well.

[0104] For instance, the cushioning layer 14 is glued to the third additional layer 18 by means of a water-based glue. The third additional layer 18 is adhered to the second additional layer 17 by means of a water-based glue as well. Further, the second additional layer 17 is also glued to the first additional layer 16 by means of a water-based glue.

[0105] These layers 14 to 18 adhered together are placed on the spring core assembly 12.

[0106] In the shown embodiment, the cushioning layer 14 and the additional layers 16 - 18 have the same height, namely 15 mm, whereas the spring core assembly 12 has a height of 195 mm or 200 mm, resulting in an overall height of 255 mm or 260 mm.

[0107] As discussed above, the additional layers 16 - 18 are made of a foam, particularly different foams. Accordingly, the respective characteristics of the additional layers 16 - 18 may differ.

[0108] A first additional layer 16 may be made by a comfort foam, e.g. a PU foam, that has a minimum netto density of 30 kg/m^3 and a hardness of 3 kPa.

[0109] The second additional layer 17 may be made by a visco-memory foam that has a minimum netto density of 50 kg/m^3 and a hardness of 1.8 kPa.

[0110] For instance, the third additional layer 18 is made by a hypersoft foam that has a minimum netto density of 32 kg/m^3 and a hardness of 1.5 kPa.

[0111] The spring core assembly 12 comprises several spring pockets 28 that are schematically shown in Figure 1. The spring pockets 28 each comprise a bottom fabric 30 as well as a top fabric 32 via which the spring pockets

28 are glued to the first additional layer 18.

[0112] Each spring pocket 28 has a spring coil 34 that is located between the bottom fabric 30 and the top fabric 32. The spring coils 34 are made of a metal wire.

[0113] The respective fabrics, namely the bottom fabric 30 and the top fabric 32, have different grammages. For instance, the grammage of the bottom fabric 30 is higher than the grammage of the top fabric 32. The several spring pockets 28 may have their own bottom fabric 30 and/or top fabric 32. Alternatively, the several spring pockets 28 may share a common bottom fabric 30 and/or a common top fabric 32.

[0114] For instance, a ratio of the grammage of the top fabric 32 to the grammage of the bottom fabric 30 is between 0.4 to 0.6, particularly 0.5.

[0115] Specifically, the grammage of the top fabric 32 may be between 60 g/m^3 and 80 g/m^3 , particularly 65 g/m^3 , whereas the grammage of the bottom fabric 30 is between 100 g/m^3 and 160 g/m^3 , particularly 138 g/m^3 .

[0116] In fact, the bottom fabric 30 provides a support surface of the entire mattress assembly 10 as shown in Figure 1.

[0117] Therefore, these different grammages of the fabrics 30, 32 ensure proper support of the spring coils 34 located within the spring pockets 28 as well as proper support for a user of the entire mattress assembly 10.

[0118] For instance, the bottom fabric 30 and the top fabric 32 are made by polypropylene (PP) fabrics, e.g. textile products that are derived from the thermoplastic polymer polypropylene.

[0119] A top view on the spring core assembly 12 is shown in Figure 1 as well to which reference is made hereinafter.

[0120] The top view illustrates that the spring core assembly 12 is established by two different types of spring pockets 28, namely a first type spring pocket 36 as well as a second type spring pocket 38.

[0121] The different type spring pockets 36, 38 distinguish from each other by their respective spring coils 34, particularly the diameter of the respective spring coils 34.

[0122] In fact, the first type spring pocket 36 has a first spring coil 42 with a diameter between 1.6 mm and 1.9 mm, particularly 1.8 mm, whereas the diameter of the second spring coil 42 is between 1.8 mm and 2.2 mm, particularly 2 mm.

[0123] For instance, the ratio of the diameter of the first spring coil 40 to the diameter of the second spring coil 42 is between 0.72 and 0.95, particularly 0.9.

[0124] In the shown embodiment, the spring core assembly 12 comprises several different zones A-I, namely nine different zones in total. The zones are established by areas defined by the different types of spring pockets 28.

[0125] Each zone A-I comprises only one type of spring pocket 28, namely either the first type spring pocket 36 or the second type spring pocket 38.

[0126] The nine different zones each comprise at least one line of the certain type of spring pockets 28.

[0127] Generally, a line of a specific type of spring

pockets 28 means that the respective spring pockets 28 are made of the same type and interconnected with each other by welding. The line of spring pockets 28 has a length that corresponds to the width W of the spring core assembly 12 or rather the mattress assembly 10.

[0128] In the shown embodiment, one line comprises fourteen spring pockets 28, irrespective of the specific type of spring pocket 28.

[0129] In fact, the first zone A comprises two lines of the second type spring pockets 38. The adjacent second zone B comprises six lines of the first type spring pockets 36. The third zone C comprises six lines of the first type spring pockets 38. The fourth zone D comprises one single line of the first type spring pocket 36. The fifth zone E comprises two lines of the second type spring pockets 38. The sixth zone F comprises one single line of the first type spring pockets 36. The seventh zone G comprises six lines of the second type spring pockets 38. The eighth zone H comprises six lines of the first type spring pockets. Finally, the ninth zone I comprises two lines of the second type spring pockets 38.

[0130] In the shown embodiment, the spring core assembly 12 has a length L of 190 cm. Therefore, the spring core assembly 12 comprises 40 lines wherein these 40 lines are interconnected with each other by gluing.

[0131] As indicated above, the respective spring pockets 28 of one line, particularly their respective spring coils 34, are interconnected with each other by welding, thereby establishing the line.

[0132] In contrast thereto, the spring pockets 28 of adjacent lines are connected with each other by gluing.

[0133] Generally, the spring pockets 28, particularly their spring coils 34, are welded to each along a first dimension, e.g. the width W.

[0134] Moreover, the spring pockets 28 are glued to each along a second dimension, e.g. the length L, which is perpendicular to the first dimension, e.g. the width W.

[0135] Further, the spring core assembly 12 is symmetrical with respect to two lines of symmetry S1 and S2 which intersect each other in the center or middle M of the spring core assembly 12.

[0136] In fact, the second symmetric axis S2 runs through the fifth zone E, particularly between both lines of the fifth zone E, namely between the sixteenth and seventeenth line of spring pockets 28 of the entire spring core assembly 12 along its length L.

[0137] The second symmetry axis S2 intersects the first symmetry axis S1 within the fifth zone E, namely between the seventh and eighth column of spring pockets 28 along the width W.

[0138] In Figure 4, a similar embodiment is shown that distinguishes from the first embodiment in that the length L of the spring core assembly 12 and the mattress assembly 10 is increased to 2 m. Therefore, the spring core assembly 12 comprises one additional line, namely 33 in total.

[0139] This additional line causes a different distribution of the zones, as eleven zones A-K are provided.

[0140] Again, the different zones A-K are established by the lines of spring pockets 28, wherein each line comprises fourteen spring pockets 28 in the shown embodiment.

5 **[0141]** Moreover, the different zones may be established by two different types of spring pockets 28, namely either the first spring pocket 36 or the second type spring pocket 38.

10 **[0142]** The first zone A comprises two lines of the second type spring pocket 38. The adjacent second zone B comprises six lines of the first type spring pocket 36. The adjacent third zone C comprises five lines. The adjacent fourth zone D comprises one single line of the first type spring pocket 36. The adjacent fifth zone E comprises two lines of the second type spring pocket 38. The adjacent sixth zone F comprises one single line of the first type spring pocket 36.

15 **[0143]** The sixth zone F also comprises the second symmetry axis S2 that runs through the single line and intersects with the first symmetry axis in the middle M.

20 **[0144]** The adjacent seventh zone G comprises two lines of the second type spring pocket 38. The adjacent eighth zone H comprises only one line of the first type spring pocket 36. The adjacent ninth zone I comprises five lines of the second type spring pocket 38. The adjacent tenth zone J comprises six lines of the first type spring pocket 36. Finally, the adjacent eleventh zone K comprises two lines of the second type spring pocket 38.

25 **[0145]** The cushioning layer 14 and the additional layers 16 - 18 are similar to the ones of the first embodiment shown in Figure 1 and, thus, reference is made thereto.

30 **[0146]** In Figure 5, a third embodiment is shown that shows a mattress assembly 10 and a spring core assembly 12 having a length of 190 cm. The size is similar to the one of the first embodiment shown in Figure 1.

35 **[0147]** Actually, the spring core assembly 12 also comprises 40 lines of spring pockets 28. In fact, the distribution of the different types of spring pockets 28, namely the first type spring pockets 36 and the second type spring pockets 38, is similar to the one shown in Figure 1. Therefore, reference is made to the explanations given above.

40 **[0148]** However, the mattress assembly 10 differs from the one shown in the first embodiment, as the additional layers 16 - 18 are made differently.

45 **[0149]** Generally, the additional layers 16, 18 each have a height of 15 mm similar to the first embodiment. Moreover, these additional layers 16 - 18 are also adhered to each other by means of the same adhesive(s).

50 **[0150]** However, the characteristics of the additional layers 16 - 18 differ from the ones of the first embodiment, e.g. due to different materials used for the additional layers 16, 18.

55 **[0151]** In fact, the first additional layer 16 is made of a visco-memory foam that has a minimum netto density of 40 kg/m³ and a hardness of 1.6 kPa. The second additional layer 17 is made of a comfort foam that has a

minimum netto density of 42 kg/m³ and a hardness of 2.5 kPa.

[0152] Therefore, the same spring core assembly 12 is used which however is used in connection with a different additional layer structure, thereby providing a mattress assembly 10 with different characteristics.

[0153] In Figure 6, a fourth embodiment is shown that is a combination of the second embodiment shown in Figure 4 and the third embodiment shown in Figure 5, as the mattress assembly 10 and the spring core assembly 12 also have a length of 2 m like the second embodiment, but the mattress assembly 10 comprises the same additional layers 16 - 18 used in the third embodiment.

[0154] Accordingly, the spring core assembly 12 of the fourth embodiment also comprises 33 lines as already discussed with respect to the second embodiment shown in Figure 4, but the additional layers 16 to 18 discussed with respect to the third embodiment shown in Figure 5.

[0155] Therefore, reference is made to the explanations given above with regard to the second and third embodiments.

[0156] Generally, the cushioning layer 14 is foldable and rollable such that the cushioning layer can be brought into a shipping state. The shipping state of the cushioning layer 14 is obtained by folding the cushioning layer 14 at least once, for instance along an axis being perpendicular to the longer side of the cushioning layer 14, and afterwards rolling up the cushioning layer 14, namely the cushioning layer 14 folded at least once. Thus, a compact size of the cushioning layer 14 is achieved such that the cushioning layer 14 can be put into a shipping bag.

[0157] Particularly, the entire mattress assembly 10 is also foldable and rollable such that the entire mattress assembly 10, comprising the spring core assembly 12 and the cushioning layer 14, can be brought into a shipping state. Accordingly, the shipping state of the mattress assembly 10 is obtained by folding the mattress assembly 10 at least once, for instance along an axis being perpendicular to the longer side of the mattress assembly 10, and afterwards rolling up the mattress assembly 10, namely the mattress assembly 10 folded at least once. Hence, the entire mattress assembly 10, namely the spring core assembly 12 and the cushioning layer 14, is folded at least one once and rolled up in its shipping state.

[0158] As the mattress assembly 10 comprises the spring core assembly 12 and the cushioning layer 14, both the spring core assembly 12 and the cushioning layer 14 are folded, for instance along an axis being perpendicular to the longer side, wherein afterwards the mattress assembly 10 folded at least once is rolled up, namely the spring core assembly 12 and the cushioning layer 14 simultaneously.

[0159] Specifically, the entire mattress assembly 10 is folded and rolled up, namely when the cushioning layer 14 is placed on top of the spring core assembly 12.

[0160] Thus, a compact size of the entire mattress

assembly 10 is achieved such that the entire mattress assembly 10 can be put into a shipping bag.

5 Claims

1. A cushioning layer (14) for a mattress assembly (10), wherein the cushioning layer (14) is configured to be placed on a spring core assembly (12) with at least one spring coil (34), wherein the cushioning layer (14) comprises a frame (20) made of a foam and a thermoplastic elastomer (TPE) grid layer (22), wherein the thermoplastic elastomer grid layer (22) is surrounded by the frame (20).
2. The cushioning layer (14) according to claim 1, wherein the thermoplastic elastomer (TPE) grid layer (22) has a hardness that is higher compared to the hardness of the frame (20), particularly by 10 % to 20 %, and a minimum netto density that is higher than the minimum netto density of the frame (20), particularly by a factor of 5 to 10, preferably by a factor of 6 to 8.
3. The cushioning layer (14) according to claim 1 or 2, wherein the thermoplastic elastomer grid layer (22) has a minimum netto density of 230 kg/m³ and/or a hardness of 2.8 kPa.
4. The cushioning layer (14) according to any one of the preceding claims, wherein the thermoplastic elastomer grid layer (22) makes up between 40 % and 70 % of the cushioning layer (14).
5. The cushioning layer (14) according to any one of the preceding claims, wherein the foam is a hypersoft foam having a minimum netto density of 32 kg/m³ and/or a hardness of 2.5 kPa.
6. The cushioning layer (14) according to any one of the preceding claims, wherein the thermoplastic elastomer (TPE) grid layer (22) has several walls (24) intersecting each other, thereby defining voids (26), wherein the thermoplastic elastomer (TPE) grid layer (22) comprises equally or differently sized voids (26).
7. The cushioning layer (14) according to claim 6, wherein the thermoplastic elastomer (TPE) grid layer (22) comprises differently sized voids, wherein in supporting areas the voids (26) have a smaller size compared to voids (26) located in other areas of the thermoplastic elastomer (TPE) grid layer (22).
8. The cushioning layer (14) according to claim 6 or 7, wherein the voids (26) have different shapes, particularly rectangular, hexagonal and/or honeycomb.

9. The cushioning layer (14) according to any one of the preceding claims, wherein the cushioning layer (14) is foldable and rollable such that the cushioning layer (14) has a shipping state in which the cushioning layer (14) is folded at least once and rolled up. 5
10. A mattress assembly (10) comprising a cushioning layer (14) according to any one of the preceding claims and a spring core assembly (12), wherein the spring core assembly (12) comprises at least one spring pocket (28) that has a bottom fabric (30), a top fabric (32) as well as at least one spring coil (34) located between the bottom fabric (30) and the top fabric (32), wherein the grammage of the bottom fabric (30) is different to the grammage of the top fabric (32). 10 15
11. The mattress assembly (10) according to claim 10, wherein the mattress assembly (10) is a stack assembly that comprises the cushioning layer (14) and the spring core assembly (12), at least two additional layers (16, 17, 18), wherein the at least two additional layers (16, 17, 18) are made by different materials, particularly different foams, in particular wherein the at least two additional layers (16, 17, 18) are positioned between the spring core assembly (12) and the cushioning layer (14). 20 25
12. The mattress assembly (10) according to claim 11, wherein the spring core assembly (12) is a bottom layer of the mattress assembly (10), wherein the cushioning layer (14) is a top layer, and wherein the at least two additional layers (16, 17, 18) are glued with each other, in particular wherein the cushioning layer (14) is glued to its adjacent additional layer (18). 30 35
13. The mattress assembly (10) according to any one of claims 11 to 12, wherein all layers have different characteristics, particularly a minimum density and/or a different hardness, and/or wherein all layers have the same height, particularly 15 mm. 40
14. The mattress assembly (10) according to any one of claims 10 to 13, wherein the spring core assembly (12) comprises a first type of spring pocket (36) and a second type of spring pocket (38), wherein both types of spring pockets (36, 38) have the same bottom fabric (30) and the same top fabric (32), wherein the grammage of the bottom fabric (30) is different to the grammage of the top fabric (32), wherein the first type spring pocket (36) has a first spring coil (40) that is located between the bottom fabric (30) and the top fabric (32), wherein the second type spring pocket (38) has a second spring coil (42) that is located between the bottom fabric (30) and the top fabric (32), and wherein the first spring coil (40) and the second spring coil (42) are different. 45 50 55
15. The mattress assembly (10) according to any one of claims 10 to 14, wherein the mattress assembly (10) is foldable and rollable such that the mattress assembly (10) has a shipping state in which the cushioning layer (14) and the spring core assembly (12) are folded at least once and rolled up.

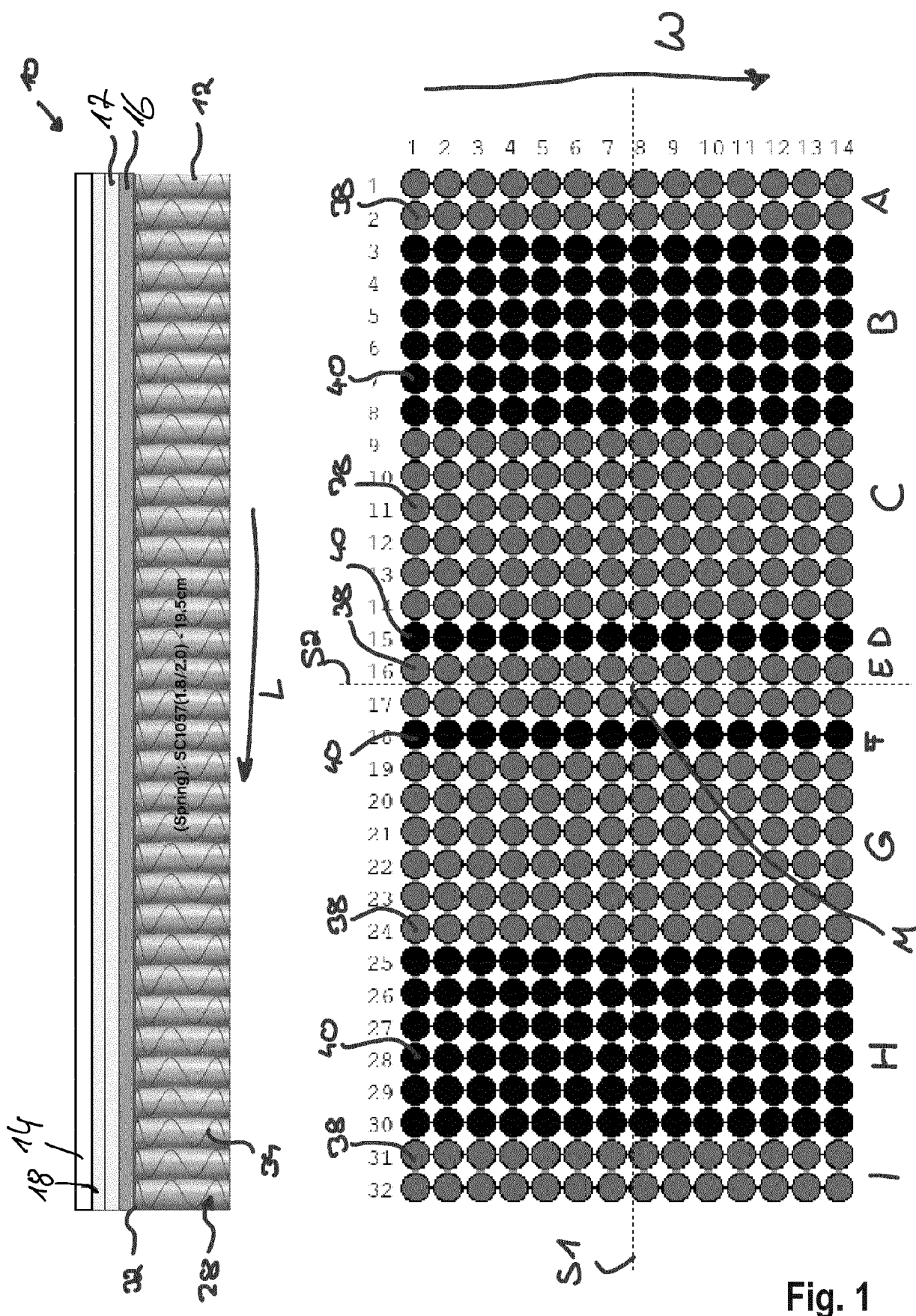


Fig. 2

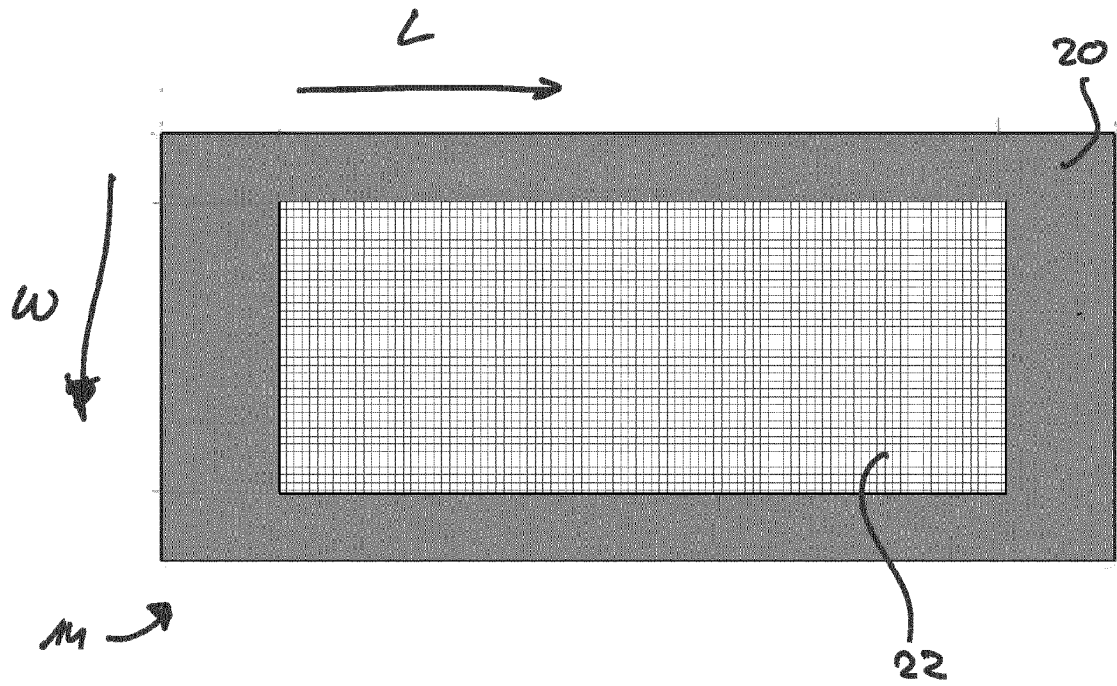


Fig. 3a)

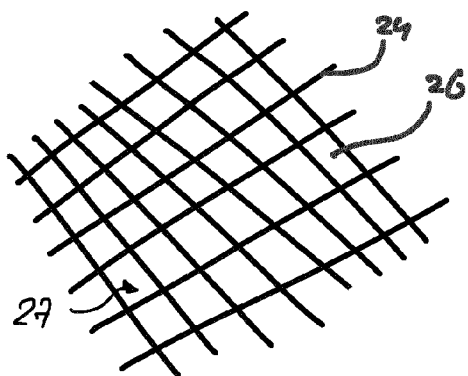
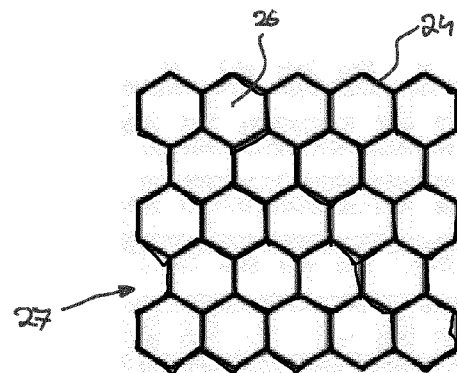


Fig. 3b)



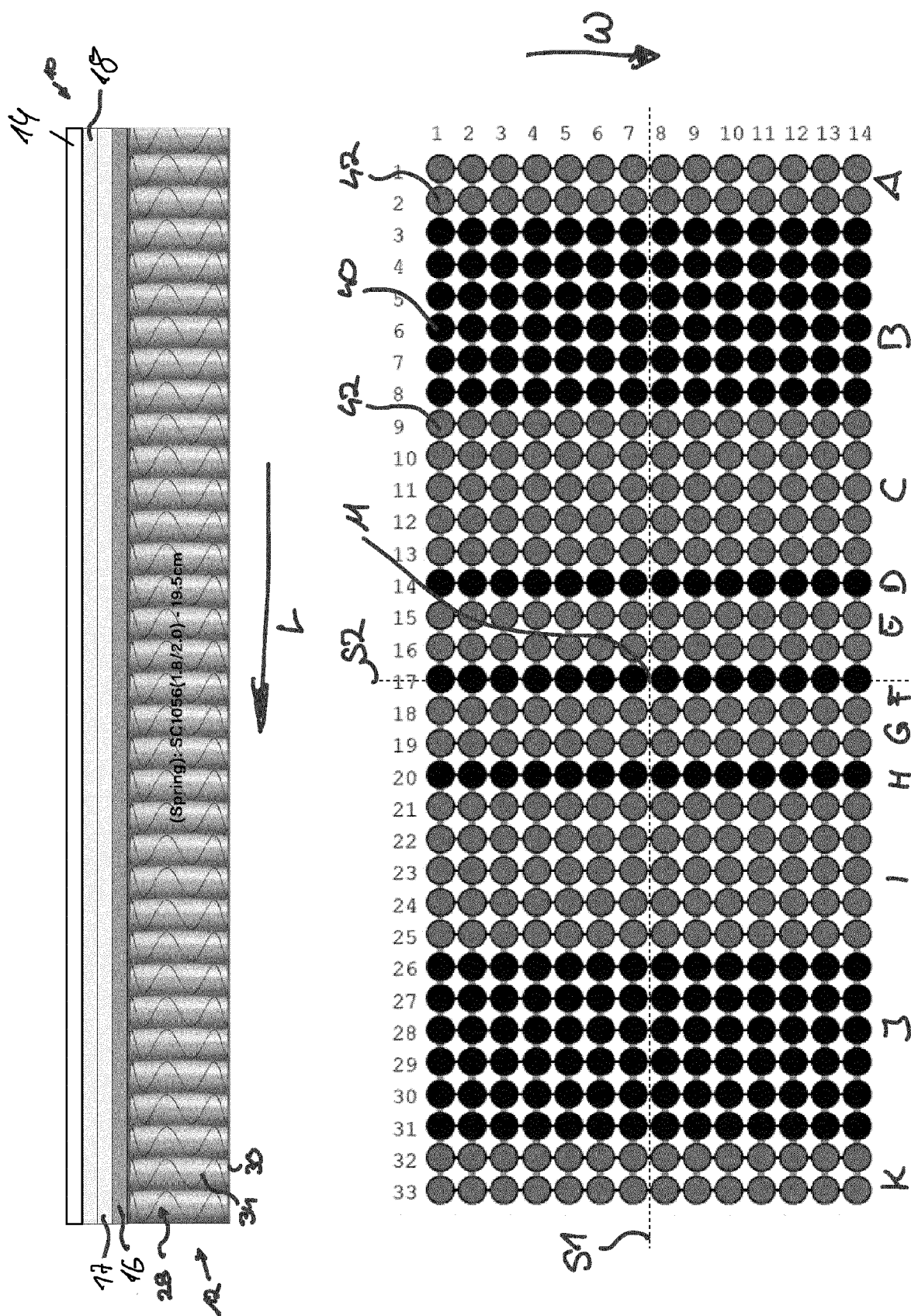


Fig. 4

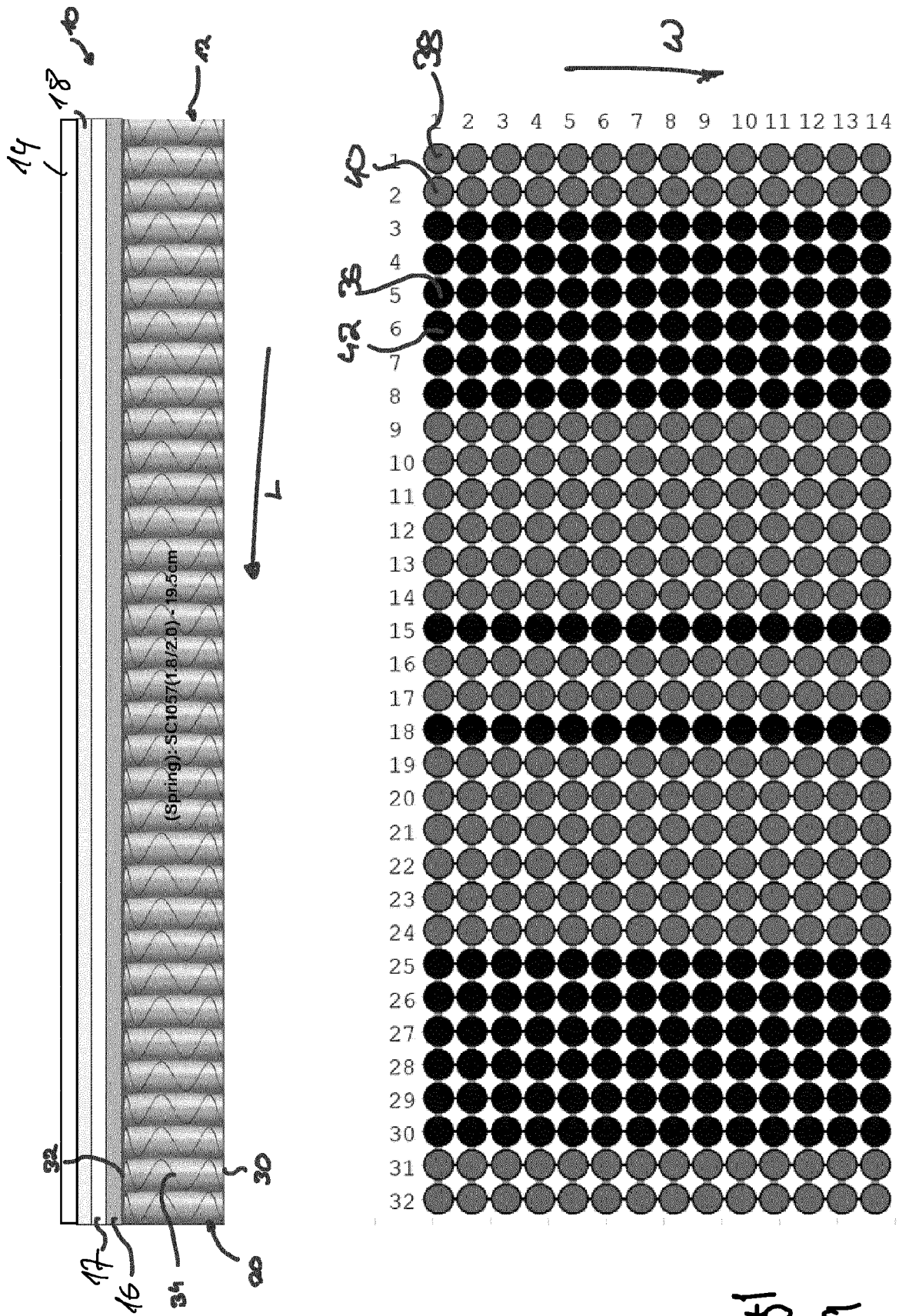


Fig. 5

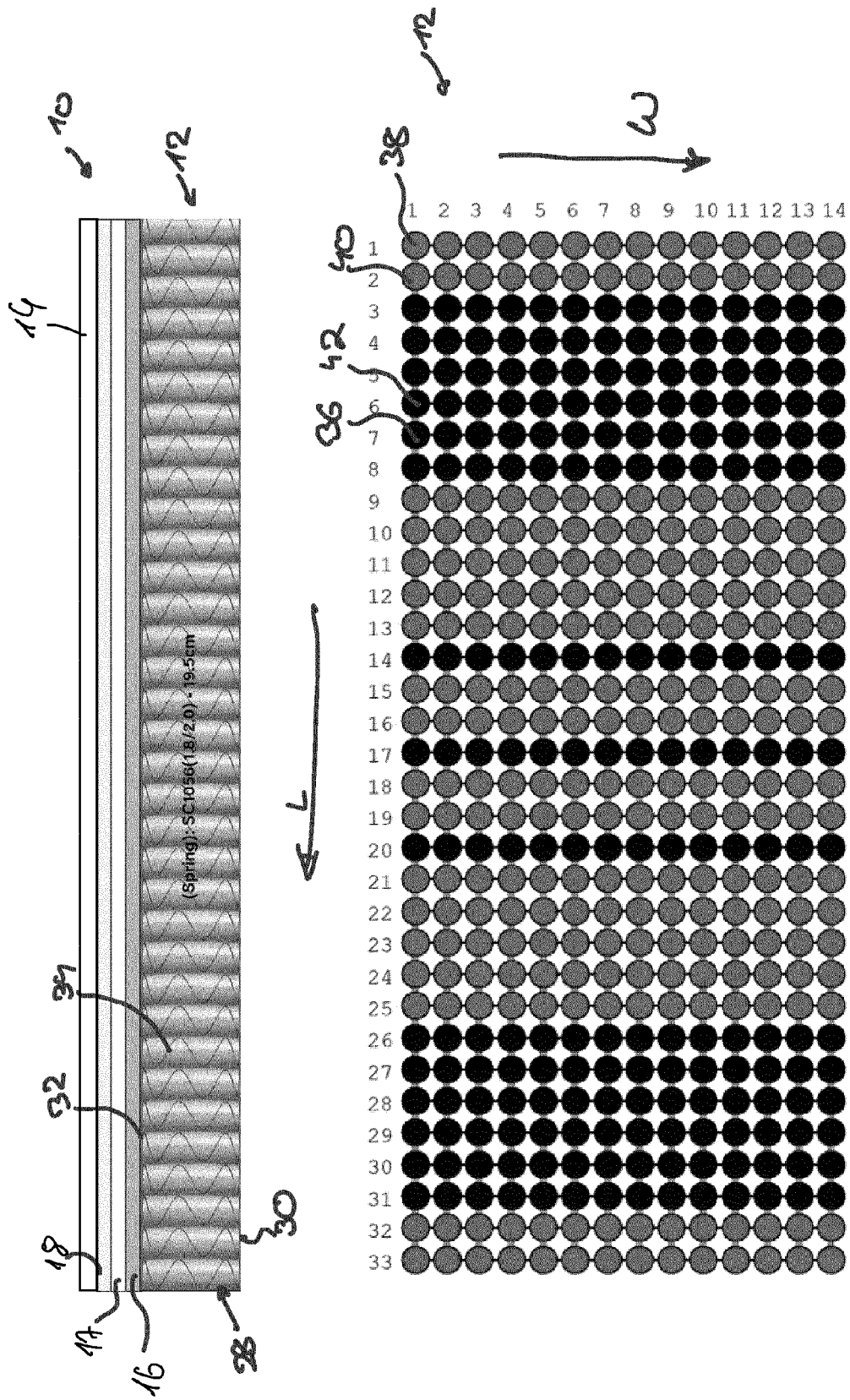


Fig. 6



EUROPEAN SEARCH REPORT

Application Number

EP 23 18 1513

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X	US 2019/150631 A1 (PEARCE TONY M [US] ET AL) 23 May 2019 (2019-05-23) * paragraph [0009] - paragraph [0091]; figures 1-15 *	1, 3, 4, 6, 10-14	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		1 December 2023	Lehe, Jörn
CATEGORY OF CITED DOCUMENTS			
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