

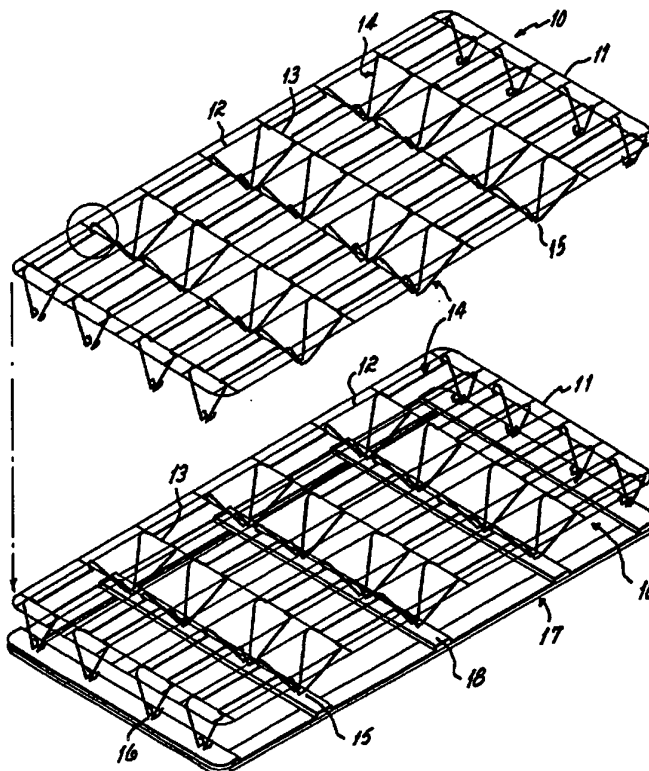


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(54) Title: NESTABLY STACKABLE FORMED WIRE FOUNDATION**(57) Abstract**

A nestable stackable spring pre-assembly (10) for a box spring foundation (17) having a top support surface formed by surface support wires (13) and longitudinal surface support wires (12) is disclosed. The top support surface is supported by a series of longitudinal formed wire structural support members (14) having V-shaped sections extending down from the top support surface. The structural support members (14) are attached to the surface support wires by clips (19). The V-sections of adjacent structural support members are angled towards each other, as seen in figure 3a, in pairs such that they form a series of four-sided open-apex pyramids. The pre-assemblies (10) can be stored and shipped by attaching a first pre-assembly to a bottom wooden frame (17), and stacking additional pre-assemblies on top of the first as seen in figure 6.



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NESTABLY STACKABLE FORMED WIRE FOUNDATION

BACKGROUND

Field of the Invention.

The present invention relates to box spring foundations used for the support of upholstered mattresses.

Background of the Invention.

Box spring mattress foundations generally include a wooden bottom frame, and an array of individual coils supporting a top grid of wires, as disclosed, e.g., in U.S. Patent No. 3,725,965 to Smith et al. The top grid of wires form the top support surface of the assembly. The foundations are finally assembled by placing a pad over the top grid of each box spring, and upholstering the complete frame/coils/grid/pad assembly under compression.

Because conventional box spring assemblies occupy a large volume, nestably stackable assemblies provide substantial economies during shipping and storage. U.S. Patents Nos. 5,052,064 and 5,361,434 to Hagemeister et al. disclose a nestably stackable foundation in which the top grid comprises a rectangular border wire and corrugated support wires. The top portions of the corrugated support wires are generally coplanar with the rectangular border wire. The bottom portions of the corrugated support wires extend substantially below the plane of the rectangular border wire, and are attached to the slats of the bottom frame.

An alternative to nestably stackable assemblies is the hinged wire assembly disclosed in U.S. Patent No. 5,346,188 to Rodgers et al. That assembly includes hingeably-connected wire form support members that are folded down to

allow compact storage or shipping of the box spring assemblies. After storage or shipping, the wire form support members are rotated down to an angle less than 90°, and are assembled to the wooden frame to form a rigid structure.

SUMMARY OF THE INVENTION

The present invention is a nestably stackable box spring pre-assembly comprised of three components: (1) a wire grid forming the top surface of the foundation; (2) formed wire support members (the "structural support wires"); and (3) clips attaching the structural support wire to the wire grid. The structural support wires provide the structural support for the top surface of the pre-assembly. It is preferably manufactured from spring wire.

The pre-assembly does not include a bottom wooden frame. After one box spring pre-assembly is attached to a bottom wooden frame, additional pre-assemblies (not attached to wooden frames) can be nestably stacked on top of the bottom box spring pre-assembly. After shipping and storage, the pre-assemblies are unstacked, and the assembly of each box spring foundation is completed by attaching its structural support wire to a wooden frame just prior to upholstering the box spring foundation, as described above with respect to conventional box springs (except for the bottom pre-assembly, which was attached prior to shipping and/or storing).

Figure 1a is a schematic diagram showing two nestably stackable box spring pre-assemblies of a first preferred embodiment of the present invention. A second box spring pre-assembly is being nestably stacked on top of a first box spring

pre-assembly. As discussed above, the first box spring pre-assembly (which is at the bottom of the stack) has already been attached to a bottom wooden frame. The top support surface of each box spring pre-assembly is formed by a rectangular wire grid array. The structural support wires, which support the top surface of the pre-assembly, extend down from the top support surface at an angle less than 90° , i.e., the plane formed by each structural support wire is at an angle that is significantly less than 90° with respect to the plane formed by the top support surface. The angle is preferably between about 45° and about 75° . More preferably, the angle ranges from about 60° to about 70° . As shown in Figure 1a, laterally adjacent support members are angled towards each other in pairs, forming a series of four-sided pyramid structures with open apexes. The base of each pyramid is in the top support surface, and the apex of each pyramid is at the bottom of the pre-assembly, i.e., the pre-assemblies are attached to the wooden frames by attaching the apexes of the pyramids to the wooden frames.

Figure 1b, as well as Figure 1a and Figure 4a (discussed below) shows that, in the preferred embodiment of the present invention, immediately after each V in the structural support wire, the structural support wire formed wire is bent laterally at 90° to form a relatively short lateral segment, then bent back parallel to the longitudinal wire to form a relatively long longitudinal offset segment. As shown in Figure 1b, in a preferred embodiment of the present invention, clips are used on the short lateral segments to attach the structural support wire to lateral

wires in the top support surface. The length of the longitudinal offset segments matches the spacing between the lateral wires in the top support surface.

Figures 2a-2b are schematic diagrams of the single formed wire forming one structural support wire. In the example shown in Figure 2a, the structural support wire has one end support member on the right side of the pre-assembly, three interior V-shaped support members at the interior of the assembly, and another end support member on the left side of the assembly. The example of Figure 2a would be used with three wooden slats running laterally across the bottom wooden frame. Figure 2b shows a four-slat example of the structural support wire. Figures 2a and 2b show that the number of interior support members can be varied to produce a box spring foundation having any desirable length and number of lateral supports. The size and number of the V-shaped support members of the structural support wire is a design choice.

Figure 3a is mainly a top side perspective view of two adjacent structural support wires, and Figure 3b is a top front perspective view of the two adjacent support wires. These Figures show that each set of adjacent structural support wires is oriented such that the lateral spacing between the structural support wires is much wider at the top than at the bottom, such that the V members form the series of open-apex four-sided pyramid structures discussed above with respect to Figure 1a.

Figure 4a is a top view of a three-slat pre-assembly, that could be used for twin-sized bed of standard length. Figure 4a shows how the structural support

wires are angled towards each other as they extend down from the top support surface. Figure 4a also shows that the short lateral segments of the structural support wires are attached to the lateral wires in the top surface at the interior of the assembly. At the ends of the assembly, on the preferred embodiment, the end longitudinal segments of the structural support wires are attached to the longitudinal support wires.

Figure 4b is a detailed view of the encircled area marked "A" in Figure 4a. Figure 4b shows how the ends of the lateral and longitudinal wires in the top support surface are wrapped around the rectangular border wire. The ends are wrapped such that they do not interfere with either the clips attaching the end of the structural support wire to the longitudinal and the lateral support wires in the top support surface, or the structural support wire itself. Figure 4b also shows the ends of two adjacent structural support wires.

Figure 4c is a detailed view of the encircled area marked "B" in Figure 4a. Figure 4c shows how the structural support wire is bent at 90° to form a short lateral segment, clipped to a lateral wire in the top support surface, then bent at 90° back in the longitudinal direction and bent downwards to form the V-shaped support member. The formed wire curves down and to the side of the longitudinal wire in the top support surface. A notch section of the structural support wire rises *above* the longitudinal wire in the top support surface, and captures the structural support wire in cooperation with clip 19. Lateral stability is achieved by the clip in the outward direction and by the notch in the inward direction.

Figure 5a shows the upside-down pyramid structure formed by adjacent support members, and how that structure is attached to the bottom wooden frame. Figure 5a shows that the apex of each pyramid does not actually come to a point, i.e., the ends of the Vs are actually flat (not pointed). This stabilizes and simplifies mounting the pre-assemblies to the wooden frames. Thus adjacent Vs are not brought into contact with each other, but are actually spaced apart. This space, in cooperation with the clipped grid attachment, allows some flexing of the mattress support surface, which is an improvement over unitized or welded assemblies. The flat sections allow the ends of the Vs to be attached to a slat in the bottom wooden frame, using staples or other types of fasteners. Figure 5a also shows how the structural support wires are attached by clips to the lateral wires in the top support surface, and illustrate the lateral capturing effect of the notches.

Figure 5b shows the end of a structural support wire, as it is attached to the end of the bottom wooden frame. The end of the V-support wire is bent back up, in the plane of the V-support wire) and brought into close proximity to the downward leg of the end section, as shown in Figure 5b. This provides a smooth, closed loop that prevents entanglement when the units are stacked and unstacked. The end of the V-support wire also has a short, flat horizontal segment, at which the end-section is stapled to the wooden frame. The Figure 5b also shows how the structural support wires are attached to the longitudinal wires, and how they are attached to the wooden frame.

Figure 6 is an end view of five stacked pre-assemblies. as a sixth pre-assembly is being added to the stack.

In a second preferred embodiment of the present invention, shown in Figure 7, an additional longitudinal support wire runs directly above the apexes of the pyramidal structure formed by the V portions of the structural support wires. The additional longitudinal support wire is parallel to and in the same plane as the other longitudinal support wires formed by the inverted pyramid structure. Because the apexes of the pyramid are open, the additional longitudinal wire slips easily in between the adjacent structural support wires, and does not prevent the pre-assemblies from being readily stacked on top of each other. The additional longitudinal support wire provides additional support to the top surface of the foundation, albeit at an additional cost in materials and labor.

These and other objects of the present invention are described in greater detail in the detailed description of the invention, the appended drawings and the attached claims.

DESCRIPTION OF THE DRAWINGS

Figure 1a is a schematic diagram of two nestably stackable box spring pre-assemblies.

Figure 1b is a detail of Figure 1a, showing how the structural support wire is bent at a right angle for a short lateral segment, such that it can be clipped to a lateral support wire.

Figure 2a is a side view of a structural support wire, designed for use with a three-slat wooden frame.

Figure 2b is a side view of a structural support wire, designed for use with a four-slat wooden frame.

Figures 3a and 3b are perspective views of two adjacent structural support wires.

Figure 4a is a top view of a three-slat pre-assembly stackable box spring.

Figure 4b is a detail showing how the end of the structural support wire is clipped to a longitudinal support wire.

Figure 4c is a detail showing how the structural support wire is clipped to a lateral support wire (except at its ends).

Figures 5a and 5b are schematic diagrams showing in perspective how the structural support wires are attached to the wooden frame in the center (Figure 5a) and at the ends (Figure 5b) of the formed wire.

Figure 6 is a side view showing a sixth pre-assembly being added to five stacked pre-assemblies.

Figure 7 is a top view of a preferred embodiment of the present invention, which has an additional longitudinal support wire placed directly above the open bay formed by the V-shaped support segments of the structural support wire.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1a is a schematic diagram showing a first box spring pre-assembly 10 attached to wooden frame 17 and to wooden slats 18. The box spring pre-assembly includes a substantially rectangular border wire 11, longitudinal wires 12 and lateral wires 13. The lateral wires are welded to the longitudinal wires at each point that these wires intersect. The box spring pre-assembly also includes a formed wire structural support wire 14 (shown also in Figures 2a and 2b), which is attached to the lateral wires 13 by clips 19. The formed wire structural support wire is attached to wooden slats 18 at the vertices 15 of the Vs in the structural support wire. It is also attached to wooden frame 17 at both ends of the structural support wire, at ends 16.

Figure 1b is a detailed view of the encircled area in Figure 1a, showing how the structural support wire is bent at 90° for a short lateral segment. The lateral segments of the structural support wire are attached to lateral wires 13 using clips 19, as shown in Figure 4c. However, as shown in Figure 4b, the ends of the structural support wire are attached to a longitudinal wire, not to a lateral wire.

Figures 2a and 2b are schematic diagrams of structural support wires 14 for a three-slat foundation and for a four-slat foundation, respectively. Figures 2a and 2b show the ends 16 of the structural support wires, and the vertices 15 of the structural support wires. The structural support wire is attached to the wooden frame and to the slats of the foundation at ends 16 and vertices 15, respectively. In the preferred embodiment of the present invention, curved segments or notches 20

of the structural support wires are formed such that they rise slightly above the longitudinal and lateral support wires (as shown in Figures 1b and 4a-4c). This restricts lateral movement of the structural support wire by trapping the fixed longitudinal wire between clip 19 and notch 20.

Figures 3a and 3b are perspective views of a portion of a structural support wire 14, showing the ends 16, the vertices 15, the short lateral segments 30 and the notches 20. Figure 3a provides a good view of the inverted pyramid structure formed by the V portions of the structural support wire. Figure 3b shows how the two adjacent structural support wires are angled towards each other, such that the plane of the structural support wires form oppositely-directed angles that are substantially less than 90°, preferably about 45° to about 75°, even more preferably about 60° to about 70°, with respect to the top support surfaces.

Figure 4a is a top view of the box spring pre-assembly showing the rectangular border wire 11, longitudinal wires 12, lateral wires 13, structural support wires 14, the vertices 15 of the structural support wires and the ends 16 of the structural support wires. Figure 4a shows that the vertices 15 of two adjacent structural support wires 14 do not actually come in contact with each other. The distance between two adjacent vertices is typically about three-quarters of an inch. However, it can be varied according to the particular requirements of the foundation.

Figure 4b is an enlarged view of the circular area marked "A" in Figure 4a. It shows how the end of the structural support wire is attached to a longitudinal

support wire 12 by clip 19. Each end 41 of a lateral support wire, or end 42 of a longitudinal support wire, is bent over rectangular border wire 11 from below, firmly attaching the support wires to the rectangular border wire.

Figure 4c is an enlarged view of the circular area marked "B" in Figure 4a. It shows how, except at the ends of the structural support wire, short lateral segments of the structural support wire are attached to the lateral support wires 13 by clips 19. Figure 4c also shows a notch 20, which rises above longitudinal wire 12, ensuring that the structural support wire cannot slide along the lateral support wire.

As shown in Figure 4a, notches 20 on adjacent structural support wires are located on alternate sides of the longitudinal wires (i.e., as shown in Figure 4a, if notch 20l is to the left of its longitudinal wire, notch 20r is to the right of its longitudinal wire). This configuration of alternate left and right notches, and clips securing the structural support wire to the lateral support wires, ensures the rigidity and stability of the formed wire foundation.

In an alternate embodiment of the present invention, the structural support wires do not include lateral segments. In that embodiment, the structural support wires are clipped to the longitudinal support wires. The notches along each structural support wire rise up on alternate sides of the longitudinal support wire, to fix the angular position of the structural support wire relative to the support surface, by physically contacting the underside of the lateral support wire.

Figure 5a is a perspective view of two adjacent structural support wires 14, showing how the structural support wires are secured to a wooden slat 18 at short flat segments 36 using, *e.g.*, staples, and to lateral support wires 13 using clips 19. Clips 19 allow a limited rotation of the lateral segments 30 of the structural support wire. The limited rotation within the clips, and the use of spring wire for the structural support wire results in a top support surface that is not completely rigid, *i.e.*, a support surface that is flexible enough to form limited contours and to flex in response to applied loads.

The length and positioning of lateral segments 30, and the angle the V sections form with the top support surface, determine the position of flat segments 36 on slats 18. The distance between two adjacent segments 36 is preferably 0.5 to 1.0 inches. For the second preferred embodiment of the present invention, discussed below with reference to Figure 7, the space between adjacent segments 36 must be sufficient to allow the structural support wires to slide readily on either side of additional longitudinal support wires 71 (shown in Figure 7).

In Figure 5a, notches 20l and 20r are shown rising slightly above longitudinal wires 12, on alternating sides of the longitudinal wires 12, *i.e.*, notch 20l is on the left of the longitudinal wire immediately next to it, and notch 20r is on the right of the longitudinal wire immediately next to it.

Figure 5b is a perspective view of two adjacent structural support wires 14, at one end of the pre-assembly, showing how the structural support wires are secured to wooden frame 17 using, *e.g.*, staples, to secure short, flat segments 32

of the end sections 16 to the wooden frame, and clips 19 to secure the structural support wire to longitudinal support wires 12. End sections 16 also include a second short segment 33, and a closing segment 34. Segments 32, 33 and 34 form a substantially closed, roughly oblong loop. As shown by Figure 5b, segment 32 can be stapled to the wooden frame using a stapling machine that accesses segment 32 from directly above. The loop formed by segments 32, 33 and 34 must be substantially closed, i.e., the size of the opening left between the end of closing segment 34 and the downward leg 35 of V-support wire 14 must be less than one-half the diameter of the structural support wire, so that succeeding pre-assemblies cannot get entangled by end sections 16. Figure 5b also shows how the longitudinal wires are attached to rectangular border wire 11, by bending longitudinal wire 12 over and around border wire 11. Lateral support wires 13 are similarly attached to rectangular border wire 11.

Figure 6 is an end view of five stacked pre-assemblies, showing a sixth pre-assembly being added to the stack. Figure 6 shows the "V" portions of structural support wires 14 extending down towards the support frame (not shown in Figure 6). Figure 6 also shows that the vertex of each "V" is open.

Figure 7 is a schematic diagram of a second preferred embodiment of the present invention. The second preferred embodiment differs from the first preferred embodiment by having an additional set of longitudinal support wires 71. Longitudinal support wires 71 are co-planar with longitudinal wires 12, but are positioned directly above the apex of the four-sided pyramid structures formed by

the "V" portion of the structural support wire. Because the vertices of the Vs are open (as shown in Figures 3a, 3b, 5a, 5b and 6), additional longitudinal support wires 71, if used, do not affect the stackability of the box spring pre-assemblies.

The foregoing disclosure of embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be obvious to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

WHAT IS CLAIMED IS:

1. A nestably stackable box spring pre-assembly comprising:

(a) a substantially rectangular border wire having two ends and two sides defining a top support surface;

(b) a plurality of lateral surface support wires extending across the top support surface attached at each end to one side of the substantially rectangular border wire;

(c) a plurality of longitudinal surface support wires extending along the length of the top support surface attached at each end to one end of the substantially rectangular border wire, and intersecting the lateral surface support wires to form intersection points, wherein each of the longitudinal surface support wires is attached to at least one of the plurality of lateral surface support wires at an intersection point;

(d) a plurality of pairs of adjacent structural support wires, each structural support wire having

(i) two end sections,

(ii) at least one V section,

(iii) a plurality of lateral sections and

(iv) a plurality of offset longitudinal sections,

said structural support wires extending substantially from one end of the substantially rectangular border wire to the other end of the substantially rectangular border wire; and

(e) a plurality of means for rigidly attaching the lateral sections of the structural support wire to the lateral surface support wires.

wherein the plane formed by the V sections of each structural support wire extends down from the top support surface at an angle that is less than 90°. such that the vertices of each V in a pair is close to but not in contact with the vertex of the other V in the same pair, and such that adjacent Vs in one pair of structural support wires form a four-sided open-apex pyramidal structure.

2. The nestably stackable box spring pre-assembly of claim 1, wherein the means for rigidly attaching the lateral sections of the structural support wires to the lateral surface support wires are clips.

3. The nestably stackable box spring pre-assembly of claim 1, wherein each structural support wire is attached to one of the longitudinal surface support wires at each end of the structural support wire.

4. The nestably stackable box spring pre-assembly of claim 1, wherein the length of each offset longitudinal section is substantially equal to the distance between the two lateral surface support wires at either end of that offset longitudinal section.

5. The nestably stackable box spring pre-assembly of claim 1, wherein the structural support wires further comprise notch sections between the lateral sections and the offset longitudinal sections, said notch sections being formed such that each notch section curves up along the side of a longitudinal surface support

wire and rises slightly above the longitudinal and lateral support wires, but nevertheless does not rise above substantially rectangular border wires.

6. The nestably stackable box spring pre-assembly of claim 5, wherein the notches in a pair of adjacent structural support wires curve up on alternate sides of the longitudinal surface support wires.

7. The nestably stackable box spring pre-assembly of claim 1, wherein the end sections extend down at an angle of substantially 90° to the top support surface.

8. The nestably stackable box spring pre-assembly of claim 1, wherein the end sections comprise a substantially closed loop end portion.

9. The nestably stackable box spring pre-assembly of claim 1, wherein the plane formed by the at least one V section of each structural support wire extends down from the top surface at an angle that ranges from about 45° to about 75° .

10. The nestably stackable box spring assembly of claim 1, wherein the plane formed by ~~the~~ ^{9/22 8/28/95} at least one V section of each structural support wire extends down from the top surface at an angle that ranges from about 45° to about 75° .
~~28 8/28/95~~

11. The nestably stackable box spring pre-assembly of claim 1, further comprising an additional plurality of longitudinal surface support wires, said additional longitudinal surface support wires being positioned directly above the open apexes of the open-apex four-sided pyramidal structure formed by adjacent Vs.

12. The nestably stackable box spring pre-assembly of claim 1, wherein the Vs comprise a short flat section at the vertex of each V.

13. The nestably stackable box spring pre-assembly of claim 1, wherein each structural support wire comprises three V sections.
14. The nestably stackable box spring pre-assembly of claim 1, wherein each structural support wire comprises four V sections.
15. The nestably stackable box spring pre-assembly of claim 1, wherein the structural support wire is formed from spring wire.
16. A structural support wire for a box spring foundation comprising:
 - (a) two end sections extending down at a 90° angle, wherein said end sections comprise a substantially closed loop end portion;
 - (b) a plurality of V sections, each V section having a short flat segment at its vertex;
 - (c) a plurality of relatively short lateral sections; and
 - (d) a plurality of relatively long offset longitudinal sections.
17. The structural support wire of claim 16, wherein the structural support wire has three V sections.
18. The structural support wire of claim 16, wherein the structural support wire has four V sections.
19. A stack of box spring pre-assemblies comprising:
 - (a) one bottom pre-assembly comprising:
 - (i) a bottom substantially rectangular border wire having two ends and two sides defining a top support surface for the bottom pre-assembly;

(ii) a plurality of bottom lateral surface support wires, extending across the top support surface of the bottom pre-assembly, attached at each end to one side of the bottom substantially rectangular border wire;

(iii) a plurality of bottom longitudinal surface support wires extending along the length of the top support surface of the bottom pre-assembly, attached at each end to one end of the substantially rectangular border wire, and intersecting the bottom lateral surface support wires to form intersection points, wherein each of the bottom longitudinal surface support wires is attached to at least one of the plurality of bottom lateral surface support wires at an intersection point;

(iv) a plurality of pairs of adjacent bottom structural support wires, each bottom structural support wire having two end sections, at least one V section, a plurality of lateral sections and a plurality of offset longitudinal sections, said bottom structural support wires extending substantially from one end of the bottom substantially rectangular border wire to the other end of the bottom substantially rectangular border wire;

(v) a plurality of means for rigidly attaching the lateral sections of the bottom structural support wire to the bottom lateral surface support wires,

(vi) a frame having two ends and two sides positioned directly below the two ends and two sides of the bottom substantially rectangular border wire, and having a plurality of slats, wherein the bottom of the end sections of the bottom structural support wires are rigidly attached to the ends of the frame, and the

bottom of each at least one V section of the bottom structural support wires is rigidly attached to the slats.

wherein the plane formed by the at least one V section of each bottom structural support wire extends down from the top support surface of the bottom pre-assembly at an angle that is less than 90°, such that the vertices of each V in a pair is close to but not in contact with the vertex of the other V in the same pair. and such that adjacent Vs in one pair of bottom structural support wires form a four-sided open-apex pyramidal structure; and

- (b) at least one additional pre-assembly comprising:
 - (i) an additional substantially rectangular border wire having two ends and two sides defining an additional top support surface;
 - (ii) a plurality of additional lateral surface support wires extending across the additional top support surface attached at each end to one side of the additional substantially rectangular border wire;
 - (iii) a plurality of additional longitudinal surface support wires extending along the length of the additional top support surface attached at each end to one end of the additional substantially rectangular border wire, and intersecting the additional lateral surface support wires to form intersection points, wherein each of the additional longitudinal surface support wires is attached to at least one of the plurality of additional lateral surface support wires at an intersection point;

(iv) a plurality of pairs of adjacent additional structural support wires, each additional structural support wire having two end sections, a plurality of V sections, a plurality of lateral sections and a plurality of offset longitudinal sections, said additional structural support wires extending substantially from one end of the additional substantially rectangular border wire to the other end of the additional substantially rectangular border wire; and

(v) a plurality of means for rigidly attaching the additional lateral sections of the additional structural support wire to the additional lateral surface support wires,

wherein the plane formed by the at least one V section of each additional structural support wire extends down from the additional top support surface at an angle that is less than 90° , such that the vertices of each V in a pair is close to but not in contact with the vertex of the other V in the same pair, and such that adjacent Vs in one pair of additional structural support wires form a four-sided open-apex pyramidal structure,

and wherein each additional pre-assembly is stacked sequentially on top of the bottom pre-assembly.

20. The stack of box spring pre-assemblies of claim 19, wherein each bottom structural support wire is attached to one of the bottom longitudinal surface support wires at each end of the bottom structural support wire, and each additional structural support wire is attached to one of the additional longitudinal surface support wires at each end of the additional structural support wire.

21. The stack of box spring pre-assemblies of claim 19, wherein the bottom structural support wires further comprise notch sections between the bottom lateral sections and the bottom offset longitudinal sections, said notch sections being formed such that they curve up along the side of a bottom longitudinal surface support wires and rise slightly above the bottom longitudinal and lateral support wires, but nevertheless do not rise above bottom substantially rectangular border wires, and wherein the additional structural support wires further comprise notch sections between the additional lateral sections and the additional offset longitudinal sections, said notch sections being formed such that they curve up along the side of a additional longitudinal surface support wires and rise slightly above the additional longitudinal and lateral support wires, but nevertheless do not rise above additional substantially rectangular border wires.
22. The stack of box spring pre-assemblies of claim 19, further comprising a further plurality of bottom and additional longitudinal surface support wires, said further plurality of bottom and additional longitudinal surface support wires being positioned directly above the open apexes of the open-apex four-sided pyramidal structure formed by adjacent Vs.
23. The stack of box spring pre-assemblies of claim 19, wherein the Vs comprise a short flat section at the vertex of each V.
24. A box spring assembly comprising:
- (a) a substantially rectangular border wire having two ends and two sides defining a top support surface for the box spring assembly;

(b) a plurality of lateral surface support wires extending across the top support surface attached at each end to one side of the substantially rectangular border wire;

(c) a plurality of longitudinal surface support wires extending along the length of the top support surface of the box spring assembly attached at each end to one end of the substantially rectangular border wire, and intersecting the lateral surface support wires to form intersection points, wherein each of the longitudinal surface support wires is attached to at least one of the plurality of lateral surface support wires at an intersection point;

(d) a plurality of pairs of adjacent structural support wires, each structural support wire having two end sections, at least one V section, a plurality of lateral sections and a plurality of offset longitudinal sections, said structural support wires extending substantially from one end of the substantially rectangular border wire to the other end of the substantially rectangular border wire;

(e) a plurality of means for rigidly attaching the lateral sections of the structural support wire to the lateral surface support wires,

(f) a frame having two ends and two sides positioned directly below the two ends and two sides of the substantially rectangular border wire, and also having a plurality of slats, wherein the bottom of the end sections of the structural support wires are attached to the ends of the frame, and the bottom of each at least V section of the structural support wires are attached to the slats, and

wherein the plane formed by the at least one V section of each structural support wire extends down from the top support surface at an angle that is less than 90°, such that the vertices of each V in a pair is close to but not in contact with the vertex of the other V in the same pair, and such that adjacent Vs in one pair of structural support wires form a four-sided open-apex pyramidal structure.

25. The box spring assembly of claim 24, wherein the means for rigidly attaching the lateral sections of the structural support wires to the lateral surface support wires are clips.

26. The box spring assembly of claim 24, wherein each structural support wire is attached to one of the longitudinal surface support wires at each end of the structural support wire.

27. The box spring assembly of claim 24, wherein the length of each offset longitudinal section is substantially equal to the distance between the two lateral surface support wires at either end of that offset longitudinal section.

28. The box spring assembly of claim 24, wherein the structural support wires further comprise notch sections between the lateral sections and the offset longitudinal sections, said notch sections being formed such that each notch section curves up along the side of a longitudinal surface support wire and rises slightly above the longitudinal and lateral support wires, but nevertheless does not rise above substantially rectangular border wires.

29. The box spring assembly of claim 24, wherein the notches in a pair of adjacent structural support wires curve up on alternate sides of the longitudinal surface support wires.
30. The box spring assembly of claim 24, wherein the end sections extend down at an angle of substantially 90° to the top support surface.
31. The nestably stackable box spring pre-assembly of claim 24, wherein the end sections comprise a substantially closed loop end portion.
32. The nestably stackable box spring pre-assembly of claim 24, wherein the plane formed by the at least one V section of each structural support wire extends down from the top support surface at an angle ranging from about 45° to about 75°.
33. The box spring assembly of claim 24, wherein the end sections extend down at an angle of substantially 90° to the top support surface, and wherein the plane formed by the at least one V section of each structural support wire extends down from the top support surface at an angle ranging from about 60° to about 70°.
34. The box spring assembly of claim 24, further comprising an additional plurality of longitudinal surface support wires, said additional longitudinal surface support wires being positioned directly above the open apexes of the open-apex four-sided pyramidal structure formed by adjacent Vs.
35. The box spring assembly of claim 24, wherein the Vs comprise a short flat section at the vertex of each V.
36. The box spring assembly of claim 24, wherein the structural support wire is formed from spring wire.

37. A nestably stackable box spring pre-assembly comprising:

(a) a substantially rectangular border wire having two ends and two sides defining a top support surface;

(b) a plurality of lateral surface support wires extending across the top support surface attached at each end to one side of the substantially rectangular border wire;

(c) a plurality of longitudinal surface support wires extending along the length of the top support surface attached at each end to one end of the substantially rectangular border wire, and intersecting the lateral surface support wires to form intersection points, wherein each of the longitudinal surface support wires is attached to substantially all of the plurality of lateral surface support wires at an intersection point;

(d) a plurality of pairs of adjacent structural support wires, each structural support wire having

- (i) two end sections,
- (ii) at least one V section,
- (iii) a plurality of lateral sections and
- (iv) a plurality of offset longitudinal sections,

said structural support wires extending substantially from one end of the substantially rectangular border wire to the other end of the substantially rectangular border wire; and

(e) a plurality of means for rigidly attaching the lateral sections of the structural support wire to the lateral surface support wires.

wherein the plane formed by the at least one V section of each structural support wire extends down from the top support surface at an angle that is less than 90°, such that the vertices of each V in a pair is next to the vertex of the other V in the same pair, and such that adjacent Vs in one pair of structural support wires form a four-sided pyramidal structure.

38. The nestably stackable box spring pre-assembly of claim 37, wherein the means for rigidly attaching the lateral sections of the structural support wires to the lateral surface support wires are clips.

39. The nestably stackable box spring pre-assembly of claim 37, wherein each structural support wire is attached to one of the longitudinal surface support wires at each end of the structural support wire.

40. The nestably stackable box spring pre-assembly of claim 37, wherein the length of each offset longitudinal section is substantially equal to the distance between the two lateral surface support wires at either end of that offset longitudinal section.

41. The nestably stackable box spring pre-assembly of claim 37, wherein the structural support wires further comprise notch sections between the lateral sections and the offset longitudinal sections, said notch sections being formed such that each notch section curves up along the side of a longitudinal surface support wire.

42. The nestably stackable box spring pre-assembly of claim 41, wherein the notches in a pair of adjacent structural support wires curve up on alternate sides of the longitudinal surface support wires.
43. The nestably stackable box spring pre-assembly of claim 37, wherein the end sections extend down at an angle of substantially 90° to the top support surface.
44. The nestably stackable box spring pre-assembly of claim 37, wherein the end sections comprise a substantially closed loop end portion.
45. The nestably stackable box spring pre-assembly of claim 37, wherein the plane formed by the at least one V section of each structural support wire extends down from the top support surface at an angle ranging from about 45° to about 75°.
46. The nestably stackable box spring pre-assembly of claim 37, wherein the end sections extend down at an angle of substantially 90° to the top support surface, and wherein the plane formed by V sections of each structural support wire extends down from the top surface at an angle ranging from 60° to 70°.
47. The nestably stackable box spring pre-assembly of claim 37, further comprising an additional plurality of longitudinal surface support wires, said additional longitudinal surface support wires being positioned directly above the apex of the four-sided pyramidal structure formed by adjacent Vs.
48. The nestably stackable box spring pre-assembly of claim 37, wherein the Vs comprise a short flat section at the vertex of each V.
49. The nestably stackable box spring pre-assembly of claim 37, wherein the structural support wire is formed from spring wire.

50. A nestably stackable box spring pre-assembly comprising:

(a) a substantially rectangular border wire having two ends and two sides defining a top support surface:

(b) a plurality of surface support wires including:

(i) lateral surface support wires extending across the top support surface attached at each end to one side of the substantially rectangular border wire, and

(ii) a plurality of longitudinal surface support wires extending along the length of the top support surface attached at each end to one end of the substantially rectangular border wire, and intersecting the lateral surface support wires to form intersection points, wherein each of the longitudinal surface support wires is attached to substantially all of the plurality of lateral surface support wires at an intersection point;

(c) a plurality of pairs of adjacent structural support wires, each structural support wire having two end sections and a plurality of V sections, said structural support wires extending substantially from one end of the substantially rectangular border wire to the other end of the substantially rectangular border wire; and

(d) a plurality of means for rigidly attaching the structural support wires to the surface support wires,

wherein the plane formed by the V sections of each structural support wire extends down from the top support surface at an angle that is less than 90°, such

that the vertices of each V in a pair is next to the vertex of the other V in the same pair, and such that adjacent Vs in one pair of structural support wires form a four-sided pyramidal structure.

51. The nestably stackable box spring pre-assembly of claim 50, wherein the means for rigidly attaching the structural support wires to the surface support wires are clips.

52. The nestably stackable box spring pre-assembly of claim 50, wherein the vertices of each V in a pair of adjacent structural support wires is close to but not in contact with the vertex of the other V in the same pair, and such that adjacent Vs in one pair of structural support wires form an open-apex pyramidal structure.

53. The nestably stackable box spring pre-assembly of claim 50, wherein the structural support wires further comprise notch sections, said notch sections being formed such that each notch section curves up along the side of a longitudinal surface support wire, and rises slightly above the longitudinal support wire.

54. The nestably stackable box spring pre-assembly of claim 53, wherein sequential notches in each structural support wire curve up on alternate sides of the longitudinal surface support wire.

55. The nestably stackable box spring pre-assembly of claim 54, wherein said notches are in physical contact with the lateral support wires.

56. The nestably stackable box spring pre-assembly of claim 50, wherein the end sections comprise a substantially closed end portion.

57. The nestably stackable box spring pre-assembly of claim 50, wherein the end sections extend down at an angle of substantially 90° to the top support surface, and wherein the plane formed by V sections of each structural support wire extends down from the top surface at an angle ranging from about 45° to about 75° .

58. The nestably stackable box spring pre-assembly of claim 50, wherein the end sections extend down at an angle of substantially 90° to the top support surface, and wherein the plane formed by V sections of each structural support wire extends down from the top surface at an angle ranging from about 60° to about 70° .

59. The nestably stackable box spring pre-assembly of claim 50, further comprising an additional plurality of longitudinal surface support wires, said additional longitudinal surface support wires being positioned directly above the apex of the four-sided pyramidal structure formed by adjacent Vs.

60. The nestably stackable box spring pre-assembly of claim 50, wherein the Vs comprise a short flat section at the vertex of each V.

61. The nestably stackable box spring pre-assembly of claim 50, wherein the structural support wire is formed from spring wire.

62. The nestably stackable box spring pre-assembly of claim 50, further comprising a frame having two ends and two sides, having a plurality of slats extending laterally from one side of the frame to the other side of the frame, wherein the bottom of the end sections of the structural support wire are rigidly attached to the ends of the frame, and the bottom of the V sections of the structural support wire are rigidly attached to the slats.

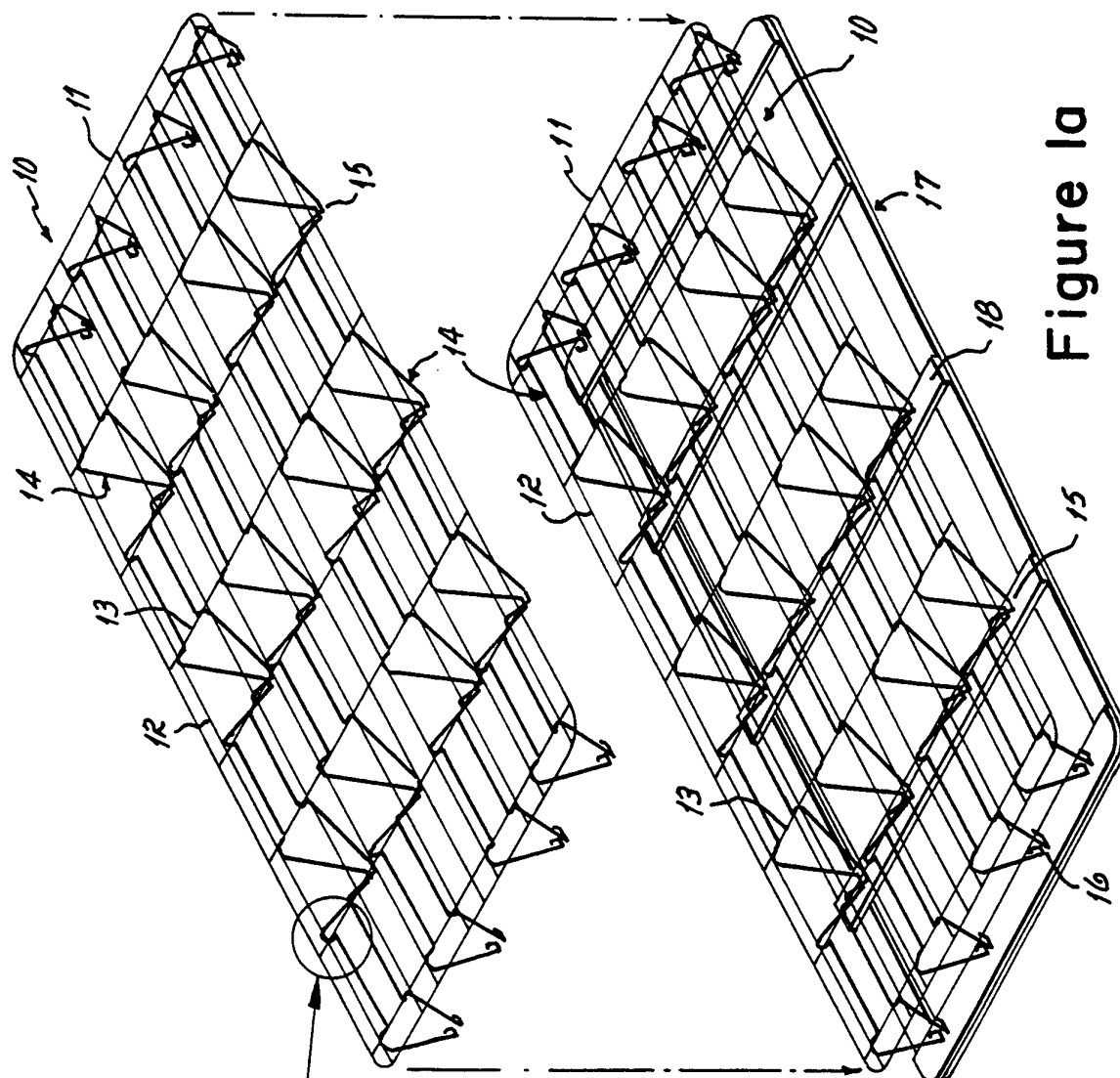


Figure 1a

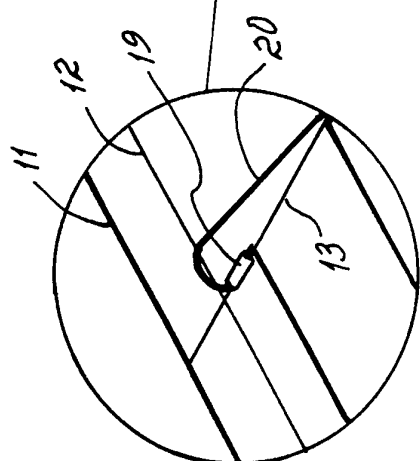


Figure 1b

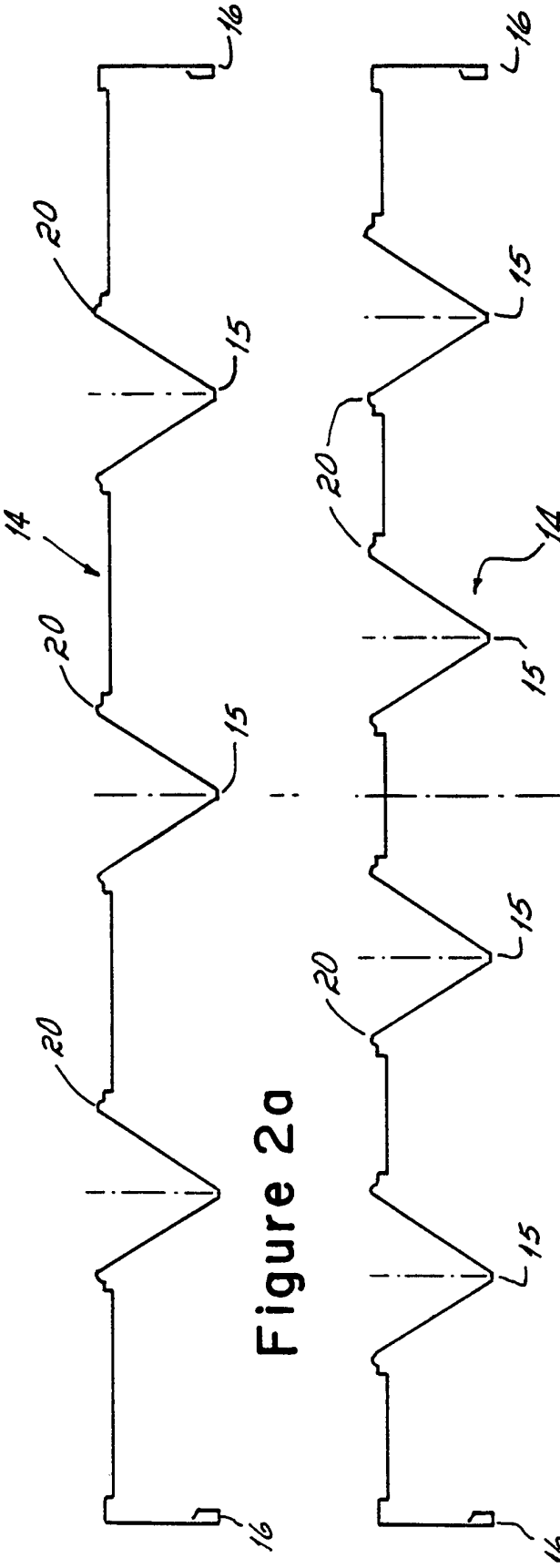


Figure 2a

Figure 2b

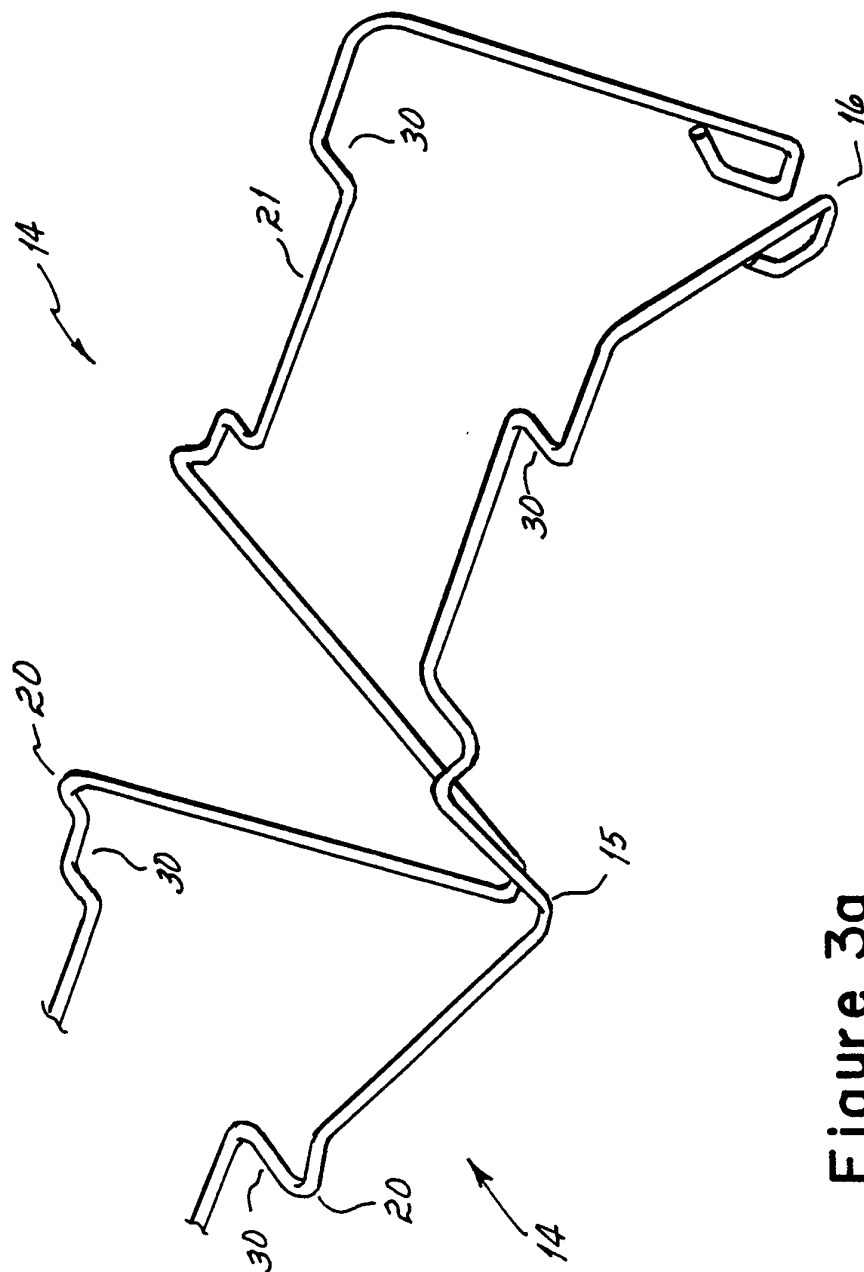


Figure 3a

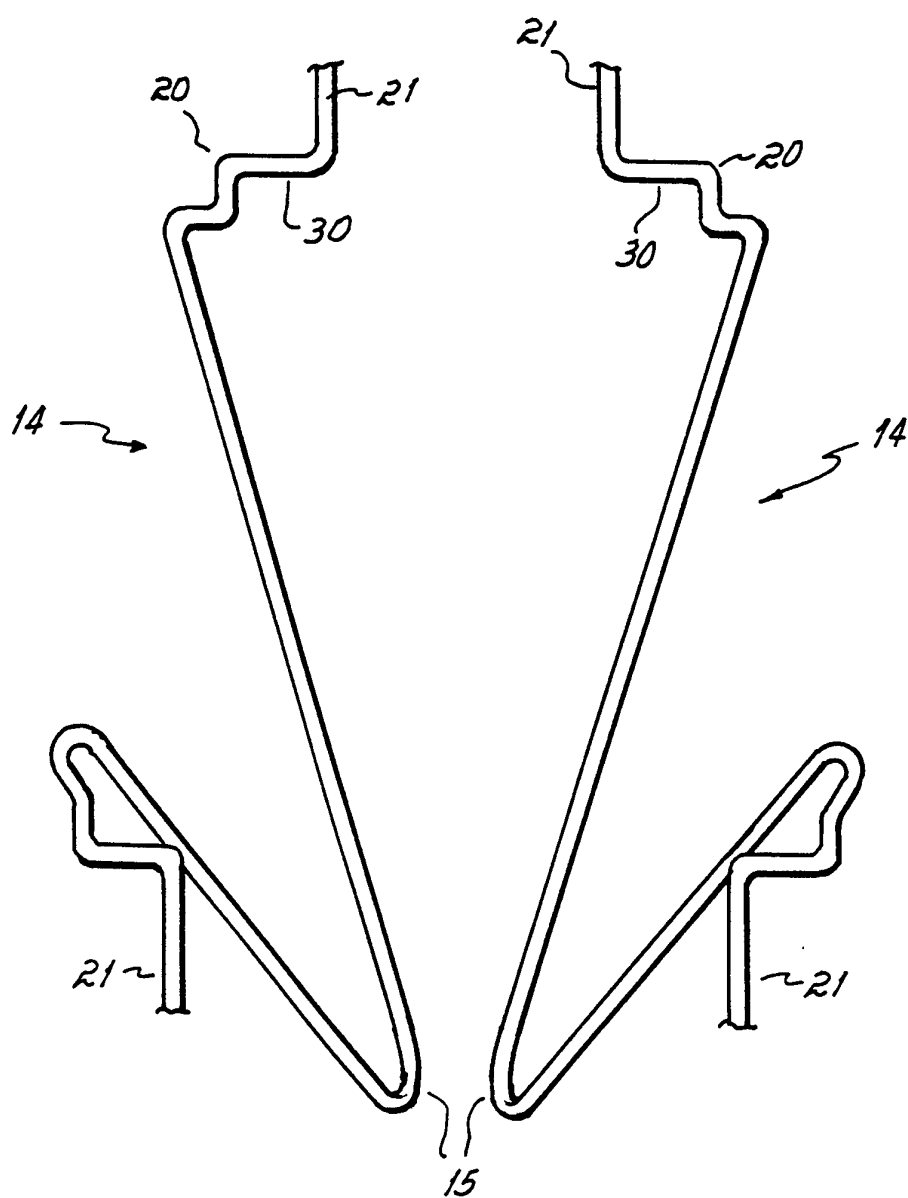


Figure 3b

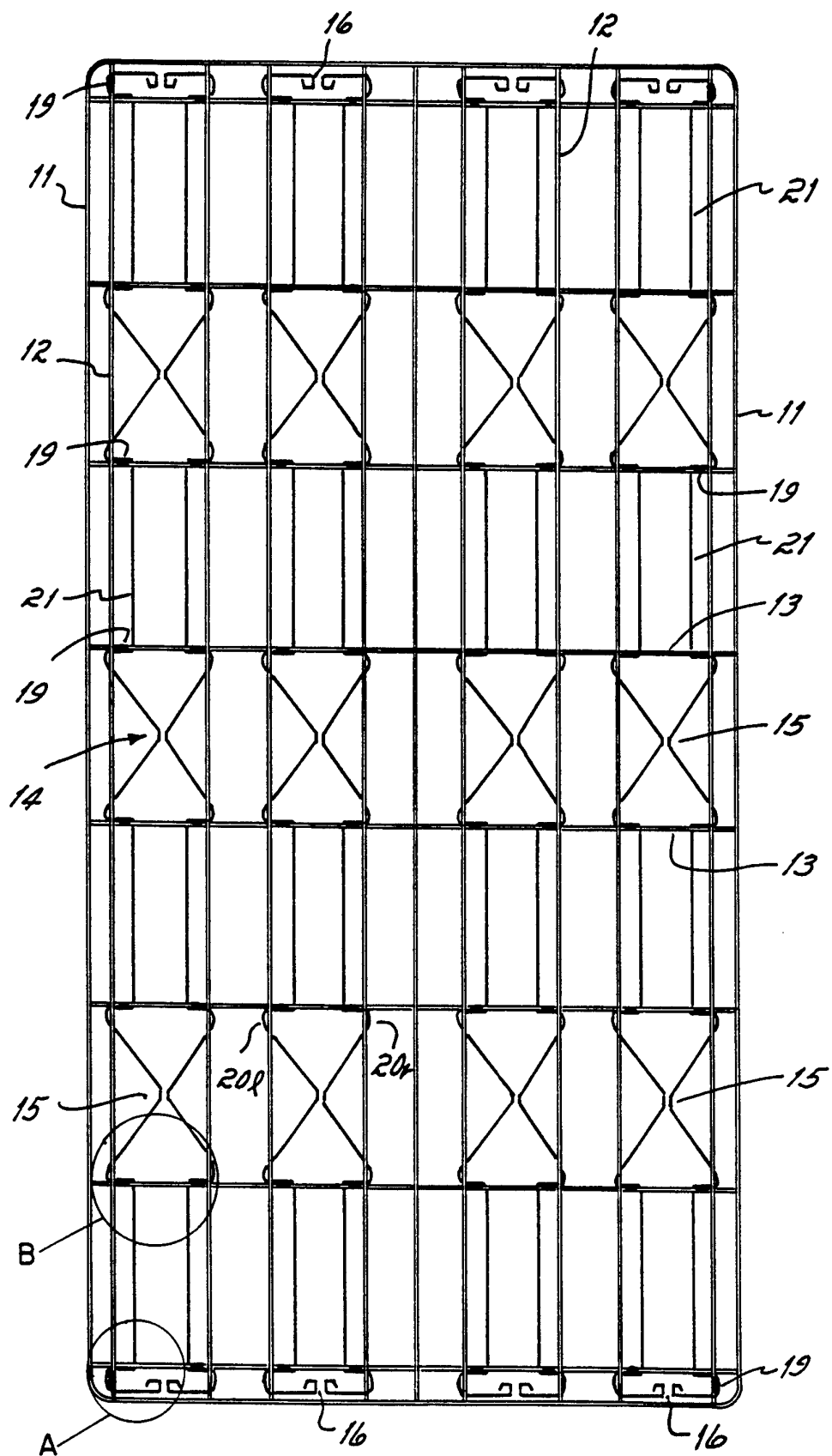


Figure 4a

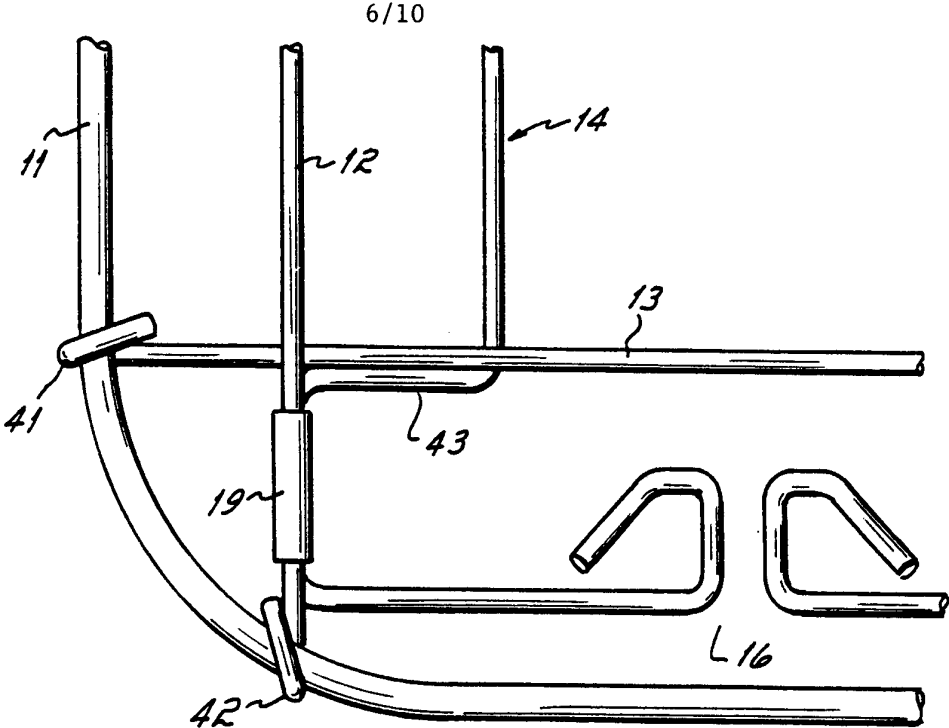


Figure 4b

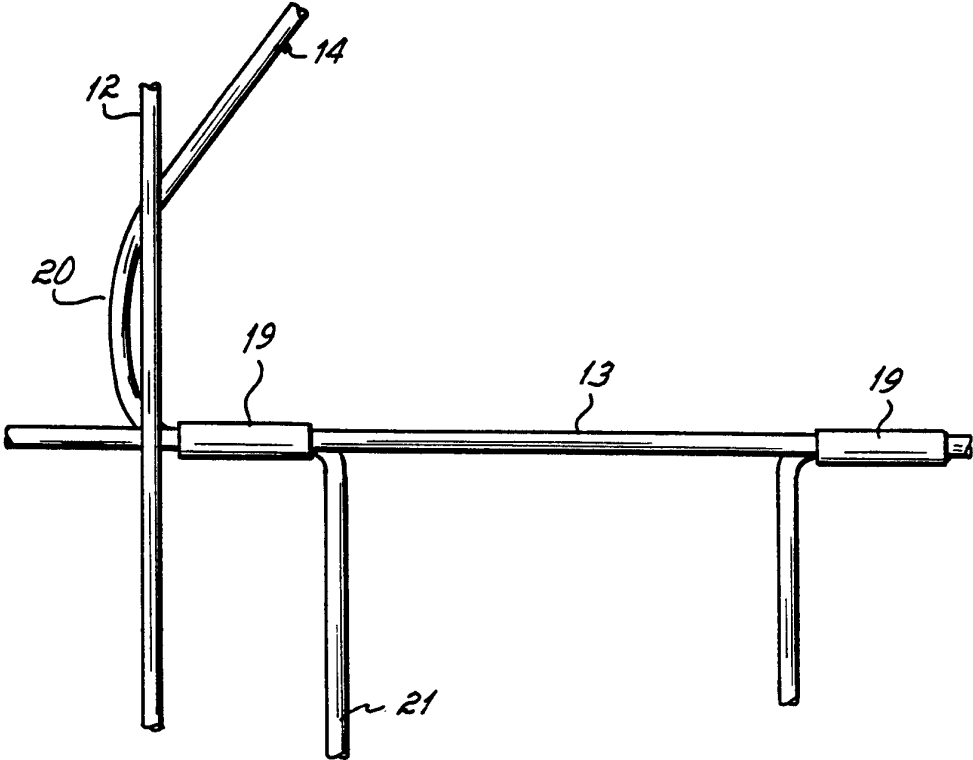


Figure 4c

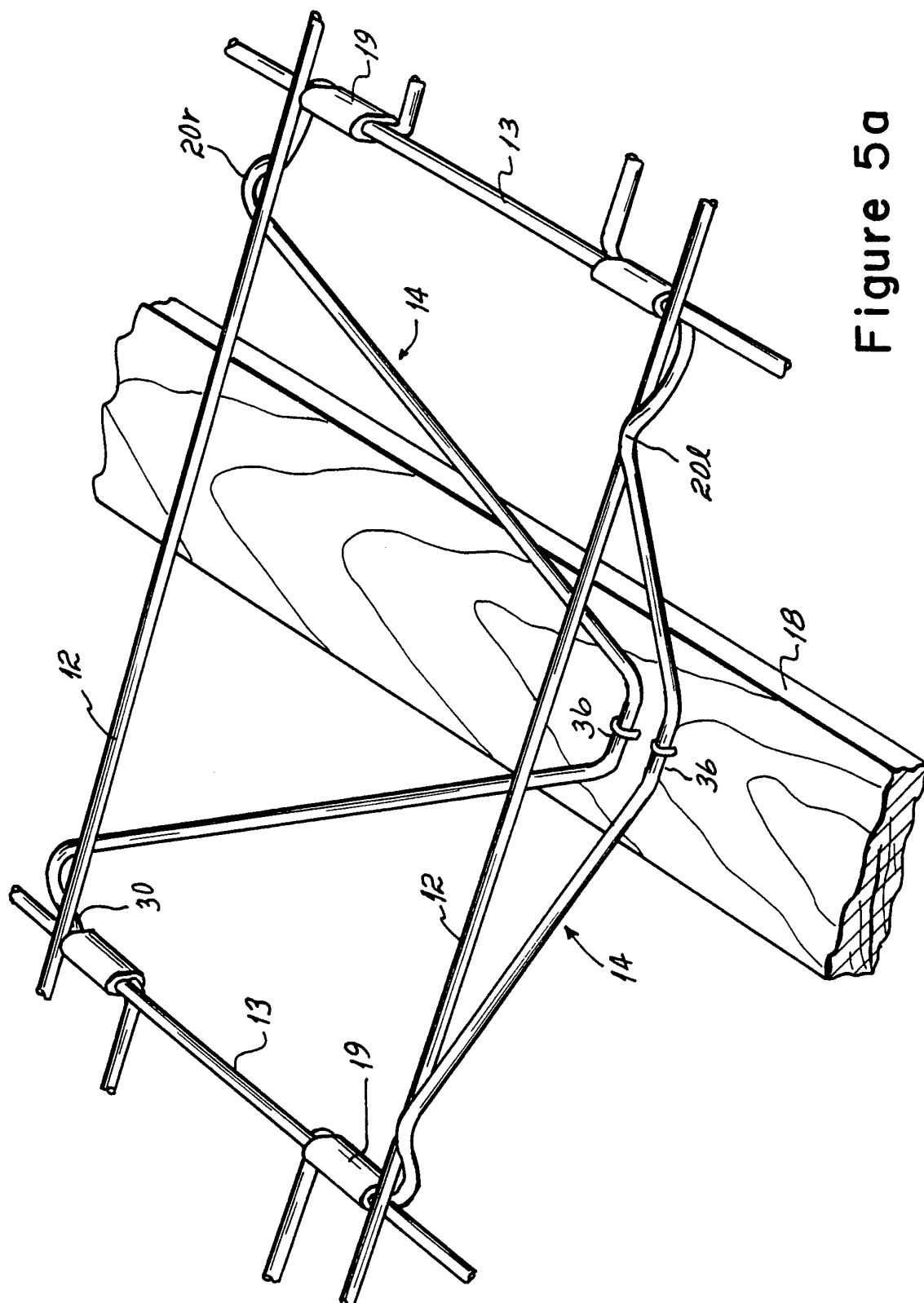


Figure 5a

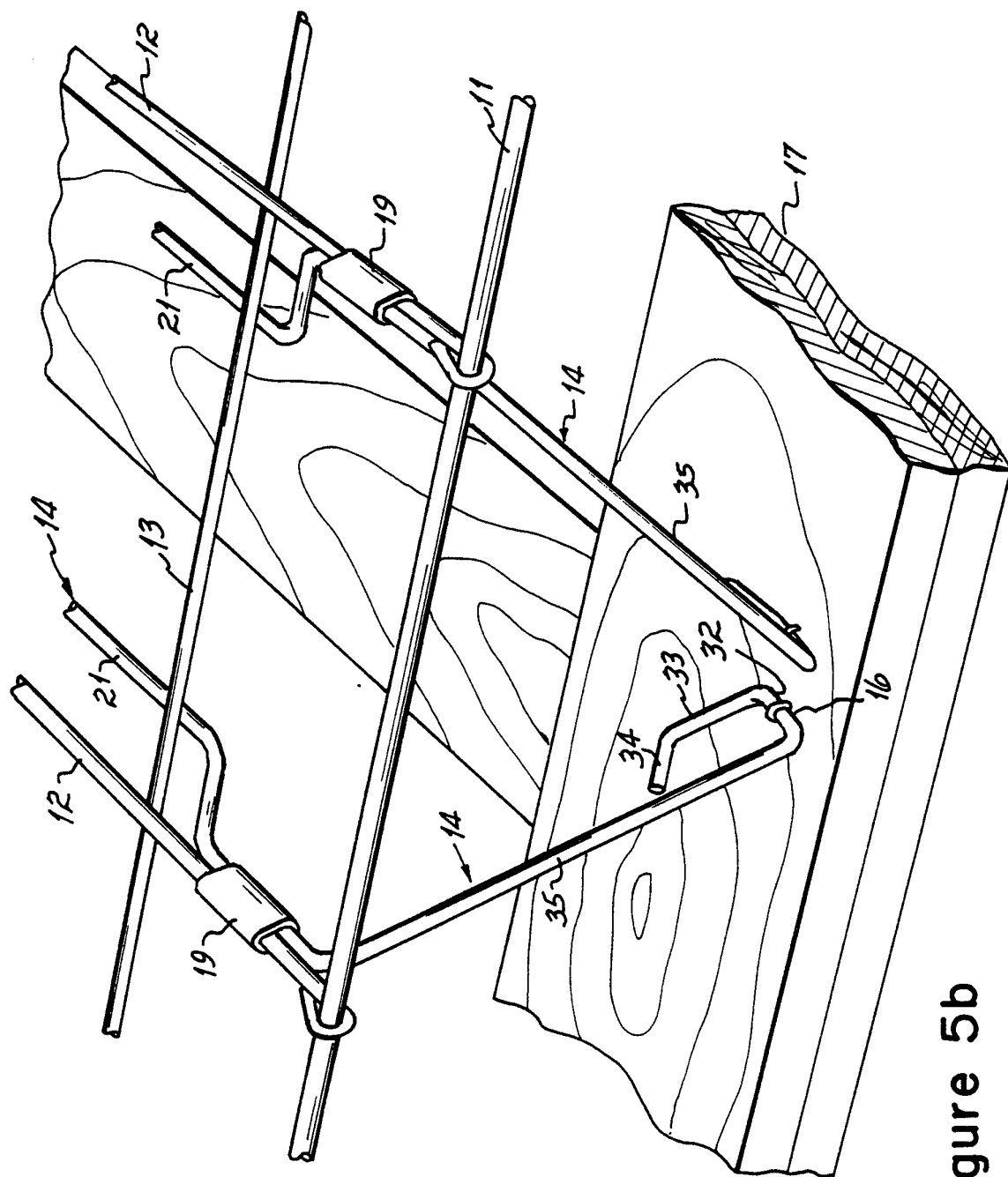


Figure 5b

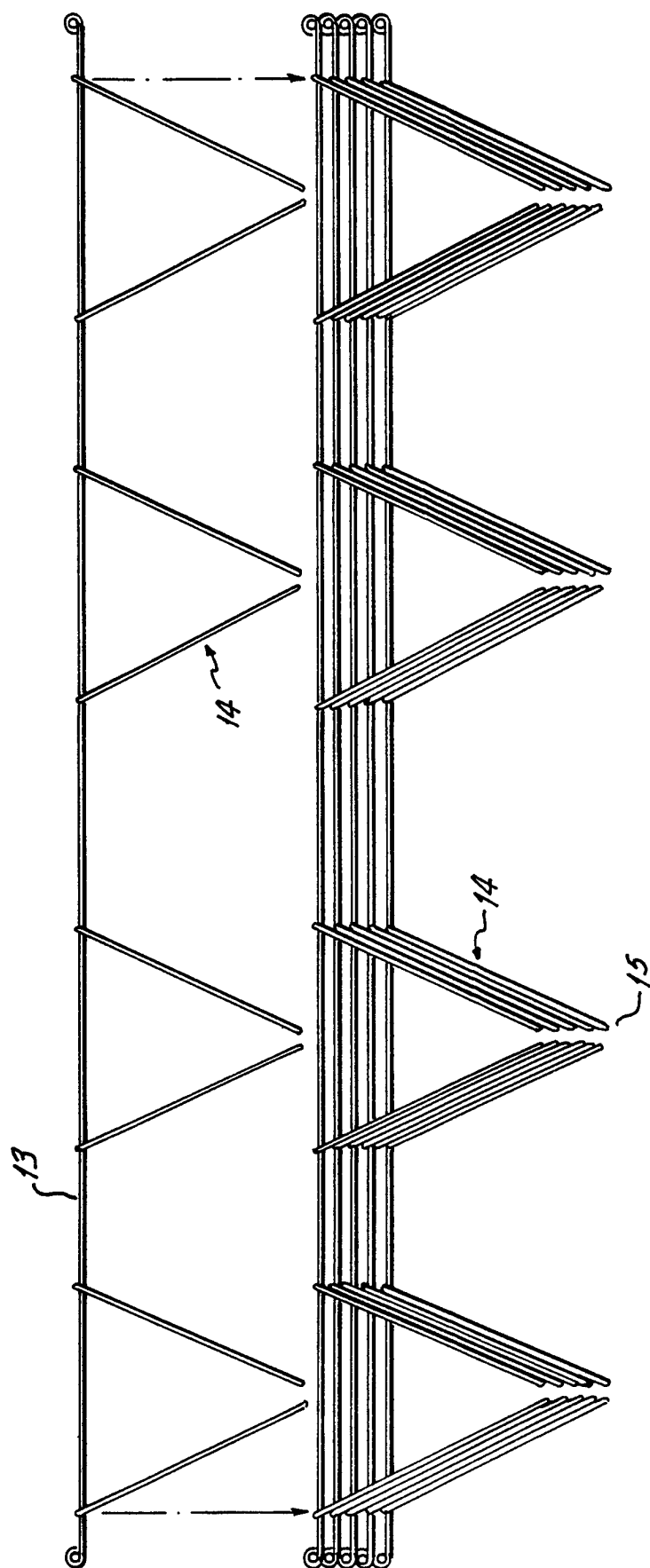


Figure 6

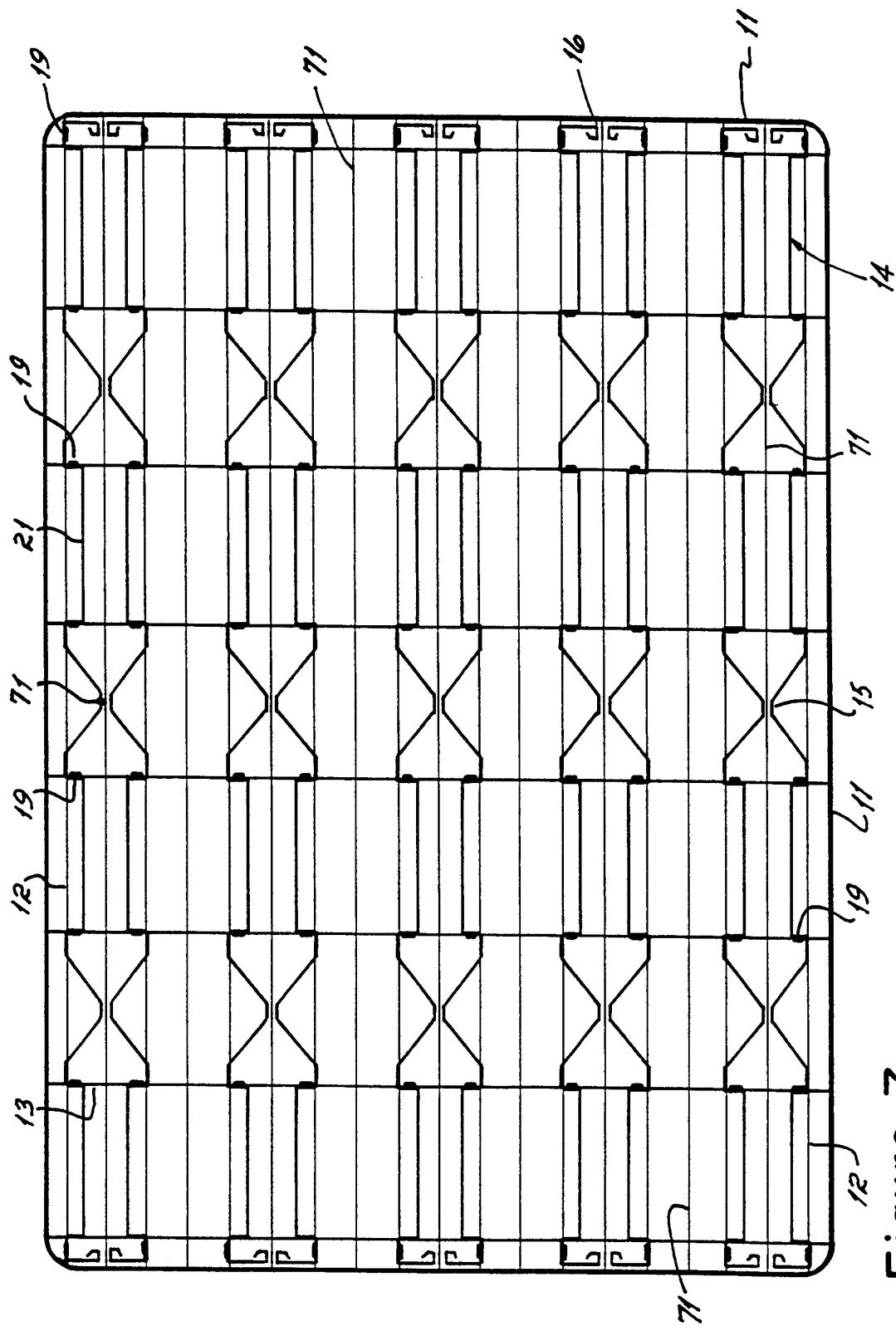


Figure 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/13880

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A47C 23/00; F16F 3/00

US CL : 267/103; 5/247

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)

U.S. : 267/103,107,109,110; 5/247,255

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,052,064 A (HAGEMEISTER et al.) 01 October 1991, see the entire document.	1-62
A	US 5,165,667 A (DABNEY) 24 November 1992, see the entire document.	1-62
A	US 5,197,155 (OGLE et al.) 30 March 1993, see the entire document.	1-62
A	US 5,346,188 A (RODGERS et al.) 13 September 1994, see the entire document.	1-62
A	US 5,395,097 A (DABNEY et al.) 07 March 1995, see the entire document.	1-62
A	US 5,562,274 A (KITCHEN et al.) 08 October 1996, see the entire document.	1-62

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*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
A document defining the general state of the art which is not considered to be of particular relevance	*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
E earlier document published on or after the international filing date	*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
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)	*G*	document member of the same patent family
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		

Date of the actual completion of the international search

08 NOVEMBER 1996

Date of mailing of the international search report

27 NOV 1996

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