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Smith et al.

[11] **3,725,965**

[45] **Apr. 10, 1973**

[54] BOX SPRING ASSEMBLY

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[52] **U.S. Cl.** **5/260,** 5/247, 5/277, 5/351

[51] **Int. Cl.**.....**A47c 23/02**

[58] **Field of Search**.....5/247, 255, 260, 5/261, 267, 276, 277, 351

[56] **References Cited**

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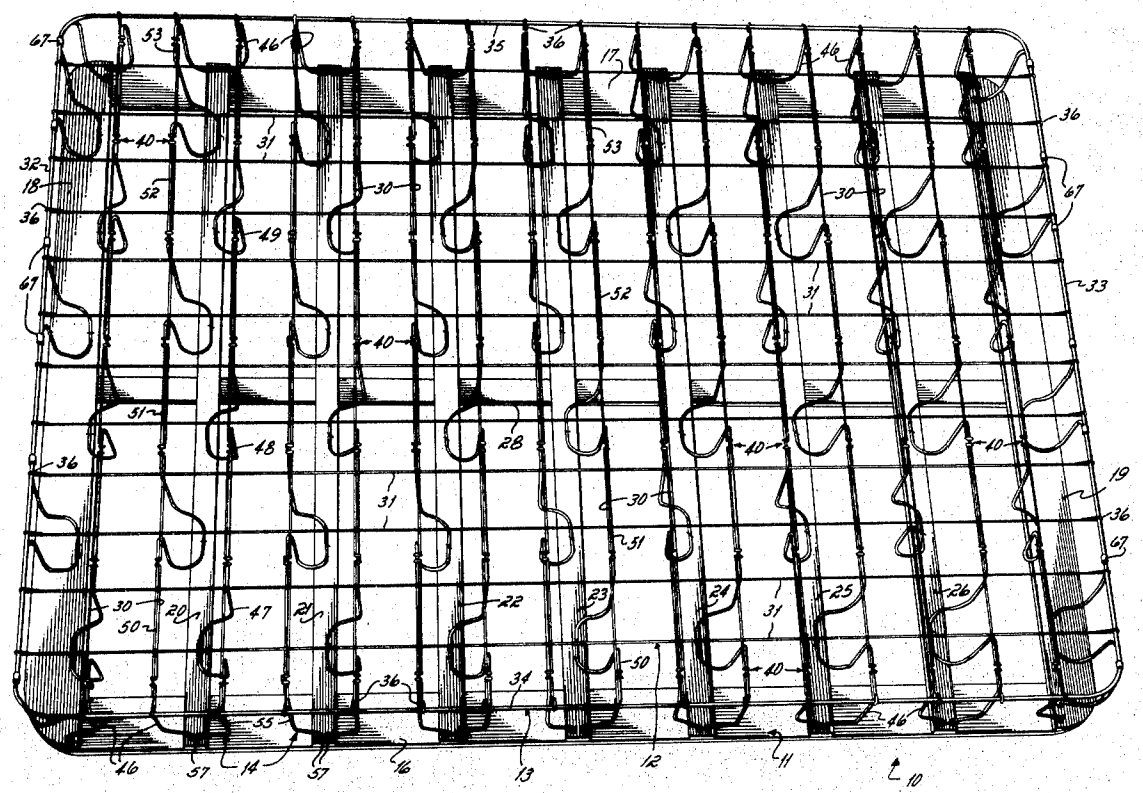
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Primary Examiner—Casmir A. Nunberg
Attorney—James S. Hight et al.

[57] **ABSTRACT**

A box spring comprising a wooden bottom frame, a border wire, a welded top grid located within and attached to the border wire, and a plurality of modular spring units interconnecting the bottom frame and the grid. Each modular spring unit comprises a single strand of wire extending between the sides of the assembly and interconnecting the top grid to the bottom frame through a plurality of individual spring units formed in the single strand of wire. Each spring of the modular spring unit comprises a loop formed in the single strand of wire. An arcuate spring section is formed in the loop to provide the resiliency of the spring. In the preferred embodiment the modular spring units are attached to the wooden frame by staples, and the welded grid is attached to the border wire by welding the ends of the wires of the grid to the border wire and by wrapping the ends of the grid wires around the border wire.

24 Claims, 5 Drawing Figures




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Fig. 1

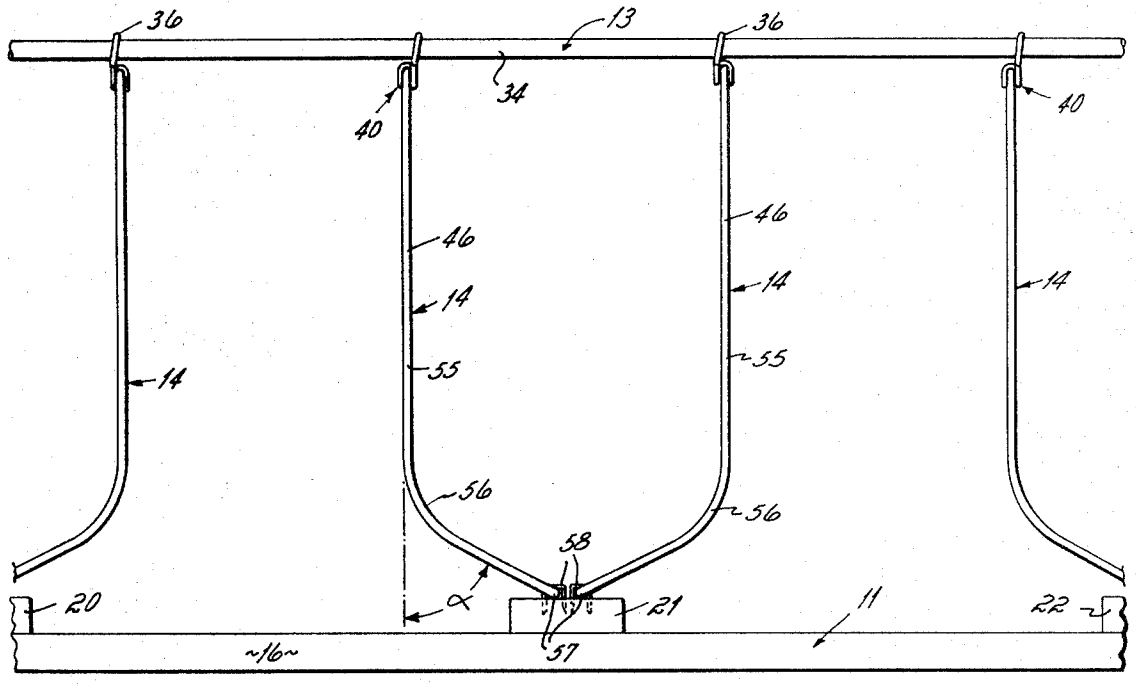

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Fig. 2

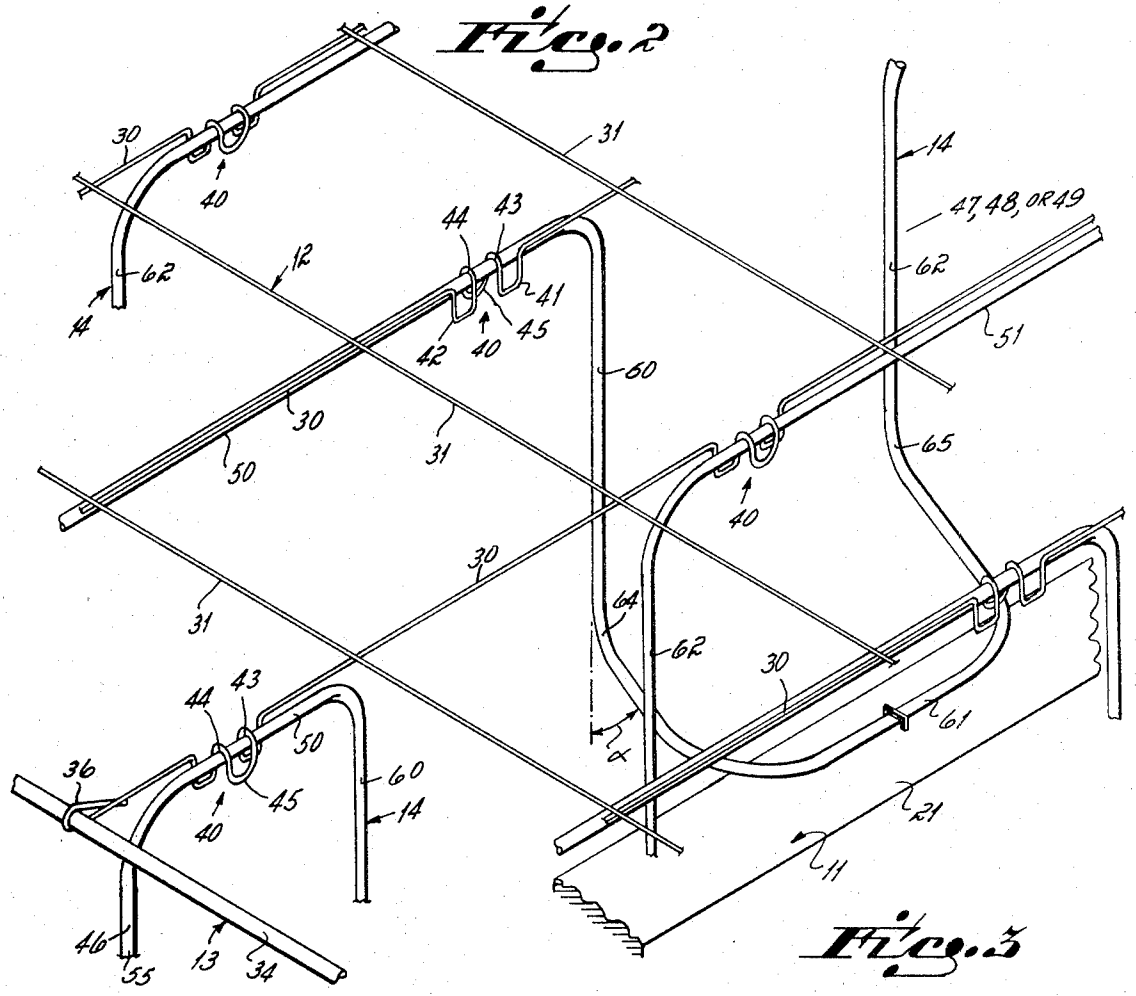

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Fig. 3

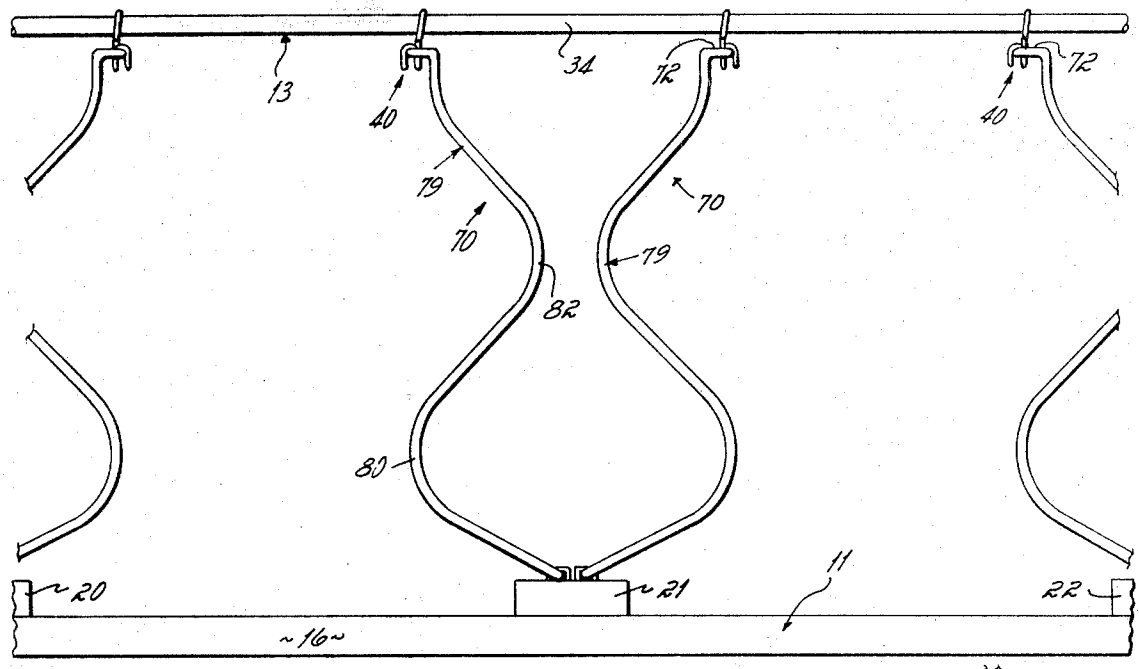

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Fig. 4

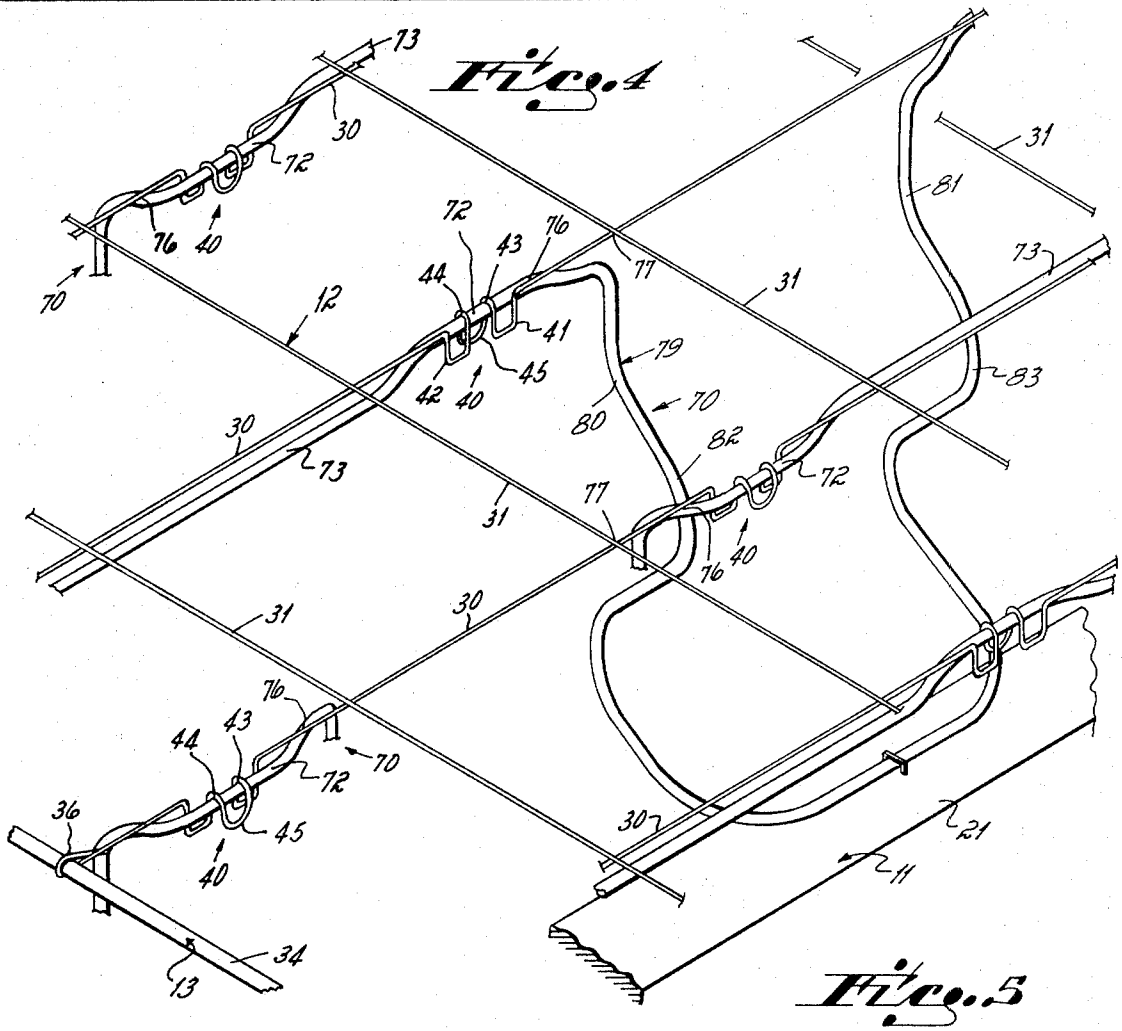

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Fig. 5

BOX SPRING ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to items of furniture, as for example, seats, chairs and mattresses; but particularly it relates to the manufacture of box spring assemblies for supporting bed mattresses.

The manufacture of box springs as it is commercially practiced today involves a great deal of hand labor. Generally, box springs are made from a multiplicity of individual coils or helical springs sandwiched between a wooden frame and a top grid of wires. The assembly is completed by placing a cushion or fabric pad over the top grid of wires and, while the whole assembly is compressed, upholstering the complete assembly. The majority of the manual labor required for manufacturing this type of box spring is required to position or situate and lock the helical springs to the wooden frame and to the top grid.

As the price of labor has increased so have the efforts to eliminate manual labor from the manufacturing process. Generally, though, these efforts have met with limited success because the construction of existing box spring assemblies is such that it is not easily or inexpensively automated.

It has therefore been a primary objective of this invention to provide a box spring assembly construction which lends itself to automatic assembly and manufacture.

Another objective of this invention has been to provide a box spring assembly which is superior in quality to existing box spring assemblies yet which may be manufactured automatically. Two principal features which determine the quality of a box spring assembly are the firmness of the assembly and its useful life. This latter quality is measured in terms of its ability to withstand a great deal of abuse in use.

The quality of firmness is generally a function of the quantity of metal utilized in the construction of the assembly. In other words, the heavier gauge metal wire employed in the springs of the assembly, the more firm will be the assembly and therefore the higher price it will bring as a quality product. The ability to stand up in use or withstand abusive use is generally a function of the techniques employed to assemble the unit and the care or attention paid to those techniques. Generally, the more points at which each spring is connected to the wooden frame and to the top grid, the longer lived it will be and the more punishment it will withstand before breaking. In order to measure the anticipated life or the ability of box spring assemblies to hold up in use, most manufacturers have some technique for measuring the useful life of a box spring, as for example, by rolling a heavy roller back and forth over the completed assembly. Similarly, the American Hotel and Motel Association has a testing procedure for measuring the useful life of a box spring which involves multiple loading and unloading of the springs of the unit.

Still another criteria of quality in a box spring assembly is the ability of the unit to withstand edge loading. Generally, the greater the edge support the better the box spring. Many of the higher quality box spring assemblies include special edge supports in addition to the springs of the unit to reinforce the border of the unit.

It has been another objective of this invention to provide a box spring assembly which meets the highest standards for firmness, useful life and edge support required by manufacturers or consumer associations for box spring assemblies while still providing an assembly which may be manufactured and assembled with a minimum of hand labor.

The box frame assembly of this invention which accomplishes these objectives comprises a wooden bottom frame, a border wire located above and spaced from the bottom frame, a welded grid located within and attached to the border wire, and a plurality of modular spring units interconnecting the welded grid and the wooden frame. Each modular spring unit is formed from a single strand of wire and includes a plurality of individual springs formed in the unit. Each individual spring comprises a loop formed in the single strand of wire which extends downwardly from the top grid to the bottom frame and has an arcuate spring section formed in it. The modular unit also has a spring formed at each end and located immediately beneath the border wire of the assembly so that the endmost springs of a unit provide increased edge support for the assembly.

The primary advantage of this box spring assembly resides not only in the quality characteristics of the assembly, i.e., the firmness, the prolonged useful life, and the superior edge support, but also in the fact that the construction particularly lends itself to automatic manufacture. Because the top mat comprises a welded grid secured to the border wire, the whole top section including the top welded grid and the border wire may be manufactured as a subassembly. Similarly, the modular springs and frame are subject to automatic manufacture and assembly.

Another advantage of this construction is that it enables a very firm box spring to be manufactured with a minimum of relatively light gauge wire. By reducing the quantity and thickness or gauge of the wire required to manufacture a box spring of a particular firmness, the total material cost of the unit is substantially reduced.

These and other objects and advantages of this invention will be more readily apparent from the following description of the drawings in which:

FIG. 1 is a perspective view of a box spring assembly incorporating the invention of this application;

FIG. 2 is a side elevational view of a portion of the box spring assembly of FIG. 1;

FIG. 3 is an enlarged perspective view of a portion of the box spring of FIG. 1;

FIG. 4 is a view similar to FIG. 2 but illustrating a modified form of modular spring unit; and

FIG. 5 is a view similar to FIG. 3 but incorporating the modified modular spring unit of FIG. 4.

Referring to FIG. 1 it will be seen that the box spring assembly **10** of this invention comprises a bottom frame **11**, a top grid **12** surrounded by a border wire **13**, and a series of modular spring units **14**.

The bottom frame comprises a pair of side boards **16**, **17** nailed or otherwise fixedly secured to a pair of end boards **18** and **19**. In the embodiment illustrated in the drawings, there are seven wooden slats **20–26** which extend transversely between and are nailed or fixedly secured to the side boards **16** and **17**. A longitudinal center slat **28** may be provided for the length of the

wooden frame as added reinforcement for the center of the slats **20–26**.

The border wire **13** is located immediately above and is spaced from the outer circumferential edge of the bottom frame **11** of the assembly **10**. It is connected to and supported by the wooden frame through the modular spring units **14**, as is explained more fully hereinafter.

The top grid **12** comprises a series of parallel transverse wires **30** and a series of longitudinal wires **31**. In the preferred embodiment there are sixteen transverse wires **30** equidistantly spaced between the opposite ends **32, 33** of the border wire and twelve longitudinal wires **31** equidistantly spaced between the opposite sides **34, 35** of the border wire. The ends of all these transverse and longitudinal wires **30,31** of the top grid are secured to the border wire by being welded to the border wire and wrapped around it, as illustrated at **36** (FIGS. **1** and **3**). In the preferred embodiment the longitudinal and transverse wires of the top grid are welded at all of their intersections so as to provide a grid subassembly which may be easily secured to the border wire and handled as an assembly unit. The welding of the longitudinal transverse wires of the top grid stabilizes the box spring assembly and increases its firmness as well as its resistance to sidesway.

Transversely spaced along each of the transverse wires **30** there are seven **3**-pronged channels **40**, each one of which is open to the bottom of the top grid. Referring to FIG. **3** it will be seen that each of these 3-pronged channels **40** comprises a pair of reversely bent fingers or prongs **41, 42** located in a common vertical plane and interconnected by transverse bends **43, 44** to a central reversely bent prong or finger **45**. The central finger is also located in a vertical plane but is spaced from the vertical plane of the fingers **41, 42** so that a channel is defined between them. In the completed assembly of the box spring, the modular spring units **14** are received within these channels **40** and may be locked therein by bending the central finger **45** beneath the wire of the modular spring unit.

Each modular spring unit **14** comprises a single strand of wire within which there are formed several individual springs. In the preferred embodiment of the invention illustrated in FIG. **1**, there are two end springs **46-46** formed in each modular unit as well as three intermediate springs **47, 48** and **49**. Each of these five springs **46–46, 47, 48** and **49** are separated by a straight section **50, 51, 52** and **53** of the wire strand.

Referring now to FIG. **2** it will be seen that each of the end springs **46–46** comprises a straight vertical leg **55** which extends downwardly from the straight section **50** or **53** of the wire strand. This section terminates at its lower end in an arcuate section **56**, the lower end of which is bent into a closed loop **57**. As may be seen most clearly in FIG. **2**, the arcuate section **56** is bent out of the vertical plane of the leg **55** through an angle α of approximately 60°. It is this arcuate section which provides the resiliency of the end springs **46–46**. The loop **57** at the end of the spring is secured to the frame by a staple **58**.

The intermediate springs **47, 48** and **49** in each of the modular spring units each comprise a vertical leg **60** which extends downwardly from one of the straight colinear sections **50, 51, 52** or **53**, a loop section **61** located at the lower end of the vertical leg **60**, and a vertical leg **62** which extends back upwardly from the loop **61** to one of the straight sections **50, 51, 52** and **53**. As may be seen most clearly in FIG. **3**, the loop portion **61** of the individual spring units **47, 48, 49** are bent out of the common vertical plane of the legs **60, 62** through an angle α of approximately 60°. It is the bent section **64, 65** of the loop portion of the individual springs which provides the resiliency in each spring.

The angle α defined by the bend in the individual springs is not critical to the operation of this invention. In fact, an angle which varies anywhere from approximately 30° to and through 90° has been found to be satisfactory so long as sufficient radius is provided on that portion **64, 65** of the bend which interconnects the loop **61** to the legs **60, 62**. This angle and the radius of the arc within which it is located, are determinative of the resiliency of the spring.

As may be seen most clearly in FIG. **1**, the outermost ones of the intermediate springs **49** and **47** are spaced differing distances from the ends of the modular spring units. Consequently, the modular spring units may be used in pairs with one unit reversed end for end from the other and with the arcuate bends **64, 65** of the individual modules facing each other. When paired in this manner the intermediate springs **47, 48** and **49** of one of the pairs are equidistantly spaced from or interleaved with the intermediate springs **47, 48, 49** of the other modular spring unit of the pair. Consequently, there is a very even distribution of resiliency of the total box spring assembly.

The modular spring units are secured to the wooden frame by having the lower ends of each of the springs of the unit stapled to either the end boards **18, 19** or the slats **20–26** of the frame. The straight sections **50, 51, 52** and **53** of the modular spring units are received in the channel **40** of the transverse wires **30** and, if desired, the central finger **45** of each of the channels is clinched or bent beneath the straight section of the modular springs so as to lock the modular springs in the channels of the transverse wires. The straight horizontal sections of the endmost ones of the modular springs are secured to the ends **32, 33** of the border wire **13** by conventional metal clips **67**.

The principal advantage of the box spring unit described hereinabove resides in the fact that it may be very easily manufactured with a minimum of manual labor on an automatic machine. This characteristic is principally attributable to the fact that the individual springs of the assembly are formed and may be assembled as portions of a modular unit.

This box spring assembly also has the advantage of a very firm edge support. This characteristic is attributable to the location of an end spring of each of the modular spring units immediately beneath the border wire. These end springs **46—46** of the modules provide greater support at the edge of the box spring than at any other point with the result that there is no need for special edge support units.

Still another advantage of this construction resides in the fact that the modular springs may be easily converted from twin bed to queen bed size by simply adding one spring to each module. The preferred embodiment illustrated in FIG. **1** is representative of a so-called full size bed. By adding a single spring to each

module, the modules may be utilized in a queen size bed. Similarly, by subtracting a single spring from each module, it may be utilized in the manufacture of twin bed size box springs. Consequently, a single machine may be utilized to manufacture spring modules for all three size box springs.

This box spring construction also has the advantage of accommodating differing heights without having to vary the height of the wooden frame of the assembly. Currently it is the practice when the box spring is to be used with a thin mattress (as for example, a foam rubber mattress) to employ a box spring of increased height. This is currently accomplished by increasing the height of the wooden frame upon which the box spring is assembled. With the construction of the box spring assembly of this invention, because it has little or no sideway, the height may be increased by simply increasing the length of the vertical legs **55**, **60**, and **62** of the assembly. In this way differing height box spring assemblies may be mounted on a single size wooden frame.

Still another advantage of this box spring assembly construction is that it eliminates the need to compress the springs when the assembly is upholstered. Current practice is to utilize helical or coil springs and to compress those springs while the upholstery is placed on the assembly. This box spring assembly may be upholstered while in the uncompressed state of the springs.

Another advantage of this box spring assembly resides in its dimensional stability. Because the intersections of the individual wires of the wire grid are welded and the ends of the individual wires of the grid are welded to the border wire and because of the firmness and dimensional accuracy curacy of the modular spring units, the assembly maintains its squareness and is always accurately sized from one unit to the next. Current practice in the box spring industry is to accept a tolerance of plus or minus one-half inch in the overall length and width of the box spring assembly. Consequently, following this commercial practice, there may be as much as one inch variance in length from one assembly to the next. The practice of this invention, though, eliminates that one inch tolerance so that the assembly is more easily upholstered and the upholstering has a neater appearance from one box spring to another.

Referring now to FIGS. **4** and **5**, there is illustrated a second embodiment of a modular spring unit incorporated into a box spring assembly. The box spring of this second modification, except for the configuration of the modular spring unit, is identical to the box spring assembly of FIGS. **1–3**. Specifically, the top wire grid **12**, the frame **11**, and the border wire **13** of this second modification are identical to the corresponding components of the modification of FIGS. **1–3**.

The modular spring units **70** of this second embodiment of the invention differ from the modular spring units of FIG. **1** in two respects: (*a*) in that the straight portions of the wire strand which interconnect the spring portions have an offset section **72** formed therein and (*b*) the vertical legs of the spring portions are configurated slightly differently from the straight vertical legs **55**, **60**, and **62** of the modular springs of the modification of FIG. **1**.

The offset **72** in the horizontal connecting sections **73** of the modular spring units are offset in the top plane of the wire grid **12**. As a result of this offset, the transverse wires **30** of the grid rest upon the top of the offset section **72** of the modular spring unit, illustrated at **76** in FIG. **5**. As a consequence of the wire grid resting upon the top of this offset portion **72** of the modular spring, there is less metal fatigue of the welds **77** at the intersection of the transverse and longitudinal wires **30**, **31** of the wire grid resulting from deflection of the springs. Consequently, the grid is longer lived than it would be in the absence of the offset **72** of the modular units.

The other feature which distinguishes these modular spring units **70** from the modular spring units **14** of the modification of FIGS. **1–3** is the configuration of the spring portion **79** of the unit. The vertical legs **80** and **81** of the spring unit rather than being straight as in the modification of FIGS. **1-3** each have a wave-shaped bend **82**, **83** formed therein so as to increase the resiliency of the unit. Except for the presence of the wave-shaped bends **82**, **83**, the springs **79** are identical to the springs of the modular unit of FIGS. **1–3**.

The box spring assembly of this second modification has all the advantages and manufacturing characteristics of the first modification described hereinabove. Additionally, though, because of the increased resiliency of this second modification, it is more readily usable in car seats, couches, or furniture where a less firm surface is desirable.

While we have described only two preferred embodiments of a box spring assembly incorporating the invention of this application, persons skilled in the art to which this invention pertains will readily appreciate that the invention of this application is applicable to other items of furniture, as for example, chairs, couches, car seats, etc. Additionally, persons skilled in this art will appreciate that differing modular spring constructions will result in different resiliency and firmness characteristics in the resulting box spring or mattress assembly; but such modifications are within the scope of the invention of this application.

Having described our invention, we claim:

1. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and connected to said side and end sections of said border wire, and

a plurality of modular spring units interconnecting said border wire and top grid to said bottom frame, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a plurality of individual springs formed throughout the length of said wire, each of said modular spring units being connected at its ends to said bottom frame and connected intermediate its ends to said bottom frame and to said top grid.

2. The box spring assembly of claim 1 in which said modular spring units extend transversely between the sides of said border wire, each of said modular spring units having connecting sections located between said individual springs, said connecting sections being parallel to and in juxtaposition to said transverse wires of said top grid.

3. The box spring of claim 2 in which said transverse wires of said grid each have a plurality of channels formed therein, each of said channels being open to the bottom of said grid, and said connecting sections of said modular spring units being received in said channels of said transverse grid wires.

4. The box spring assembly of claim 1 in which said modular spring unit comprises

a single strand of wire having generally colinear straight sections located in a horizontal plane and interconnected by a plurality of springs formed throughout the length of the wire,

each of said springs having a first generally vertical portion extending downwardly from one of said straight sections, a loop portion connected to the lower end of said first vertical portion, and a second generally vertical portion extending upwardly from said loop portion to another of said straight sections,

said loop portion of each of springs being bent through an arc of between 30° and 90° out of the common vertical plane through both of said first and second portions of said spring so that the deflection of said springs occurs in the arcuate loop portion of said spring.

5. The box spring assembly of claim 4 in which said opposite ends of each of said modular spring units terminate in an end spring, each of said end springs having a vertical portion located beneath said border wire and terminating in an arcuate spring section bent through an arc of between 30° and 90°, said arcuate spring sections of said end springs being connected at their outer ends to said bottom frame so that said end springs provide substantial edge support for said box spring assembly.

6. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and secured to said side and end sections of said border wire,

a plurality of modular spring units, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a plurality of individual springs formed throughout the length of said wire, each of said modular spring units being connected intermediate its ends to said bottom frame and to said top grid,

the opposite ends of each of said modular spring units terminating in an end spring, each of said end springs having a portion located immediately beneath said border wire and terminating at its lower end in an arcuate spring section, said arcuate spring sections being connected at their outer ends to said bottom frame so that said end springs provide substantial edge support for said box spring assembly.

7. The box spring assembly of claim 6 in which said modular spring units extend transversely between the sides of said border wire, each of said modular spring units having connecting sections located between said individual springs, said connecting sections being parallel to and in juxtaposition to said transverse wires of said top grid.

8. The box spring of claim 7 in which said transverse wires of said grid each have a plurality of channels formed therein, each of said channels being open to the bottom of said grid, and said connecting sections of said modular spring units being received in said channels of said transverse grid wires.

9. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and connected to said side and end sections of said border wire, and

a plurality of modular spring units interconnecting said border wire and top grid to said bottom frame, each of said modular spring units comprising a single strand of wire extending between the sides of said assembly and having generally colinear straight sections located in a horizontal plane and interconnected by a plurality of springs formed throughout the length of the wire,

each of said springs having a first generally vertical straight portion extending downwardly from one of said straight sections, a loop portion connected to the lower end of said first vertical portion, and a second generally vertical straight portion extending upwardly from said loop portion to another of said straight sections,

said loop portion of each of springs being bent through an arc of between 30° and 90° out of the common vertical plane through both of said first and second generally vertical portions of said spring so that the deflection of said springs occurs in the arcuate loop portion of said spring.

10. The box spring assembly of claim 9 in which said opposite ends of each of said modular spring units terminate in an end spring, each of said end springs having a vertical portion located beneath said border wires and terminating in an arcuate spring section bent through an arc of between 45° and 90°, said arcuate spring sections of said end springs being connected at their outer ends to said bottom frame so that said end springs provide substantial edge support for said box spring assembly.

11. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and connected to said side and end sections of said border wire, and

a plurality of modular spring units interconnecting said border wire and top grid to said bottom frame, each of said modular spring units comprising a single strand of wire extending between the sides of said assembly and having generally colinear straight sections located in a horizontal plane and interconnected by a plurality of springs formed throughout the length of the wire,

each of said springs having a first generally sinuous wave-shaped portion extending downwardly from one of said straight sections, a loop portion connected to the lower end of said generally sinuous wave-shaped portion, and a second generally sinuous wave-shaped portion extending upwardly from said loop portion to another of said straight sections.

12. The box spring assembly of claim **11** in which said opposite ends of each of said modular spring units terminate in an end spring, each of said end springs having a sinuous wave-shaped portion located beneath said border wires, and each of said end springs being connected at its lower end to said bottom frame so that said end springs provide substantial edge support for said box spring assembly.

13. A modular spring unit adapted to be used to form the spring section of an item of furtniture, said unit comprising

a single strand of wire having generally colinear straight sections located in a horizontal plane and interconnected by a plurality of springs formed throughout the length of the wire,

each of said springs having a first generally vertical portion extending downwardly from one of said straight sections, a loop portion connected to the lower end of said first vertical portion, and a second vertical portion extending upwardly from said loop portion to another of said straight sections,

said loop portion of each of springs being bent through an arc of between 30° and 90° out of the common vertical plane through both of said first and second portions of said spring so that the deflection of said springs occurs in the arcuate loop portion of said spring.

14. The modular spring unit of claim **13** in which the opposite ends of said strand of wire terminate in an end spring, each of said end springs having a vertical portion terminating in an arcuate spring section bent through an arc of between 30° and 90°, said arcuate spring section of said end springs terminating in means for attaching said spring units to a frame.

15. A modular spring unit adapted to be used to form the spring section of an item of furniture, said unit comprising

a single strand of wire having generally colinear straight sections located in a horizontal plane and interconnected by a plurality of springs formed throughout the length of the wire,

each of said springs having a first generally wave-shaped vertical portion extending downwardly from one of said straight sections, a loop portion connected to the lower end of said first vertical portion, and a second generally vertical wave-shaped portion extending upwardly from said loop portion to another of said straight sections,

said loop portion of each of springs being bent through an arc of between 30° and 90° out of a vertical plane which passes through said colinear straight sections of said wire so that at least a part of the deflection of said springs occurs in the arcuate loop portion of said spring.

16. The modular spring unit of claim **15** in which the opposite ends of said strand of wire terminate in an end spring, each of said end springs having a generally wave-shaped vertical portion terminating in an arcuate spring section bent through an arc of between 30° and 90°, said arcuate spring section of said end springs terminating in means for attaching said spring units to a frame.

17. A spring assembly comprising

a bottom frame,

a border wire vertically spaced from said bottom frame,

a top grid of transverse and longitudinal grid wires extending between and connected to said border wire, said grid wires being welded to one another at the intersections therebetween, and

a plurality of modular spring units interconnecting said top grid and said bottom frame, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a plurality of individual springs formed throughout the length of said wire, each of said modular spring units being connected at its ends to one of said bottom frame and border wire and connected intermediate its ends to said bottom frame and to said top grid.

18. The box spring assembly of claim **17** in which said modular spring units extend transversely between the sides of said border wire, each of said modular spring units having connecting sections located between said individual springs, said connecting sections being parallel to and in juxtaposition to said transverse wires of said top grid.

19. The box spring of claim **18** in which said transverse wires of said grid each have a plurality of channels formed therein, each of said channels being open to the bottom of said grid, and said connecting sections of said modular spring units being received in said channels of said transverse grid wires.

20. A spring assembly comprising

a bottom frame,

a border wire vertically spaced from said bottom frame,

a top grid of transverse and longitudinal grid wires extending between and secured to said side and end sections of said border wire, said grid wires being welded to one another at the intersections therebetween, and

a plurality of modular spring units, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a plurality of individual springs formed

throughout the length of said wire, each of said modular spring units being connected intermediate its ends to said bottom frame and to said top grid,

the opposite ends of each of said modular spring units terminating in an end spring, each of said end springs having a portion located immediately beneath said border wire and terminating at its lower end in an arcuate spring section, said arcuate spring sections being connected at their outer ends to said bottom frame so that said end springs provide substantial edge support for said box spring assembly.

21. The box spring assembly of claim **20** in which said modular spring units extend transversely between the sides of said border wire, each of said modular spring units having connecting sections located between said individual springs, said connecting sections being parallel to and in juxtaposition to said transverse wires of said top grid.

22. The box spring of claim **21** in which said transverse wires of said grid each have a plurality of channels formed therein, each of said channels being open to the bottom of said grid, and said connecting sections of said modular spring units being received in said channels of said transverse grid wires.

23. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and connected to said side and end sections of said border wire, said top grid defining the top of said box spring assembly, and

a plurality of modular spring units interconnecting said border wire and top grid to said bottom frame, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a pair of end springs and a plurality of intermediate springs formed throughout the length of said wire, each of said end springs being connected to said bottom frame adjacent said border wire and said intermediate springs being connected to said bottom frame and to said top grid.

24. A box spring assembly comprising

a rectangular bottom frame, said bottom frame having side boards and end boards connected at their ends and a plurality of transverse slats extending between said side boards,

a rectangularly configurated border wire having a pair of oppositely disposed side sections and end sections overlying said rectangular frame,

a top grid of transverse and longitudinal wires extending between and connected to said side and end sections of said border wire, said top grid defining the top of said box spring assembly, and

a plurality of modular spring units interconnecting said border wire and top grid to said bottom frame, each of said modular spring units comprising a single wire extending between the sides of said assembly and having a pair of end springs and a plurality of intermediate springs formed throughout the length of said wire, each of said end springs being connected to said bottom frame adjacent said border wire and said intermediate springs being connected to said bottom frame and to said top grid,

said end springs of each of said modular spring units being spaced differing distances from the adjacent intermediate spring,

said modular spring units being arranged in pairs, with each modular spring unit of a pair reversed end for end from the other modular spring unit of the pair, and

the intermediate springs of one of each pair of modular spring units being interspaced between the intermediate springs of the other modular spring unit of the pair.

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