Sept. 14, 1965 M. LEVINE 3,205,513

COIL-SPRING ASSEMBLY

Filed March 17, 1964

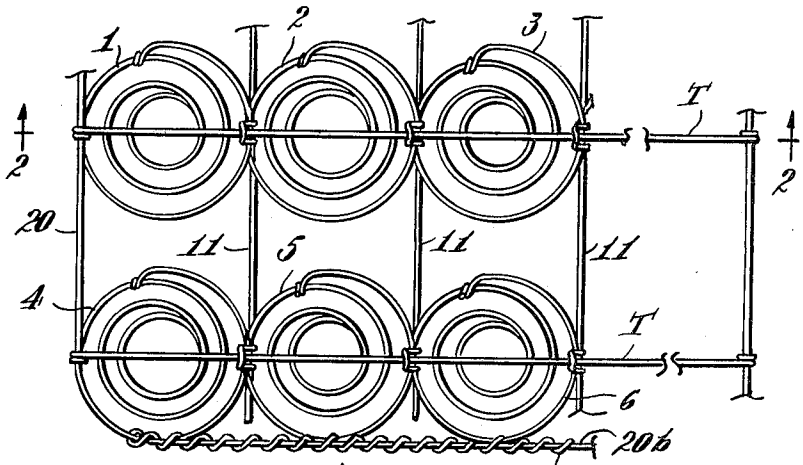


Fig. 1

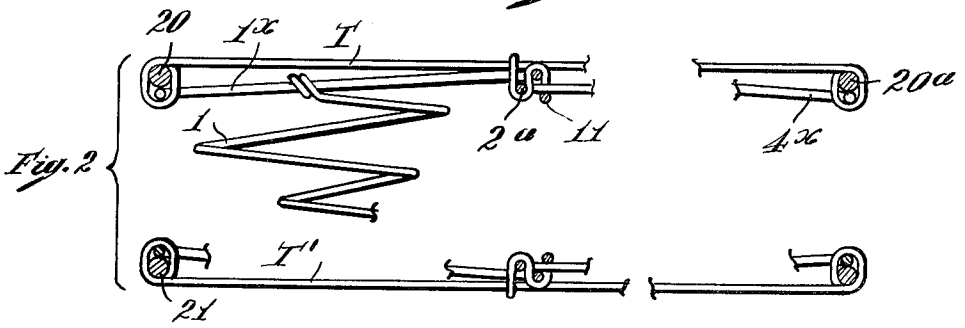


Fig. 2

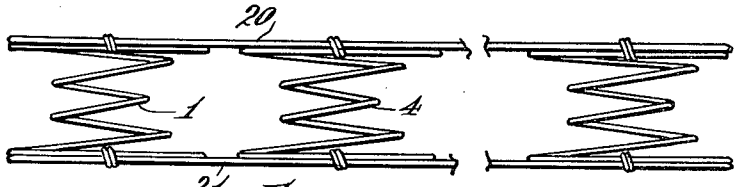


Fig. 3

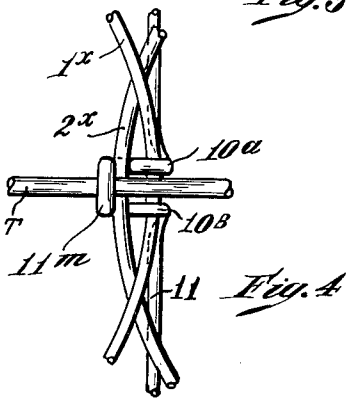


Fig. 4

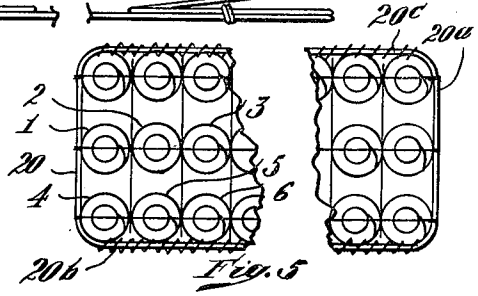


Fig. 5

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COIL-SPRING ASSEMBLY

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This invention pertains to spring assemblies of the kind employed as the resilient filling in mattresses, cushions, chair seats, or the like. Such a spring commonly comprises a plurality of parallel rows of juxtaposed coiled springs, the springs of one row being substantially aligned with the corresponding springs in the next row and the juxtaposed springs in one row being tied to the corresponding juxtaposed springs in the next row. The present invention constitutes an improvement upon the spring assembly disclosed in Patent No. 2,197,131, granted to David I. Levine, under date of April 16, 1940.

In recent years there has developed a demand for spring assemblies of the above type which provide a firmer support than was the customary earlier practice. This is particularly true with reference to inner-spring mattresses or box springs for beds where the supporting surface is of substantial extent and where it is desirable that local sagning under load be minimized. This characteristic is especially desirable in a box spring which forms a platform for the support of a mattress and which is required to provide a substantially horizontal flat upper surface on which the mattress may rest. The principal object of the present invention is to provide a spring assembly of such construction that its upper surface remains substantially flat and horizontal, even though sustaining a locally applied load.

In spring assemblies as heretofore designed, it has been quite customary to tie together the upper and lower ends of adjacent spring coils of each individual row and it has also been proposed, as in the above patent, No. 2,197,131, to tie the upper convolutions of springs of adjacent rows to each other. Usually, the assembly also comprises a rectangular frame, for example of heavy wire, providing an enclosure within which the upper ends of the constituent spring coils are arranged and with a similar frame forming a boundary enclosure for the lower ends of the springs. However, as previously devised, such frames have contributed but little to the stiffness of the assemblies as a whole as respects resistance to sagging under load.

In accordance with the present invention, provision is made whereby such an enclosing frame is utilized as an element of means whereby all of the springs of a given row are so united, at least at their upper ends, and so supported or suspended that the effect of a locally imposed load is distributed among a plurality of springs and, at the same time, the effective resistance to depression of each individual spring is increased. Thus, the upper surface of the assembly remains substantially flat.

In the attainment of this result and assuming that the spring assembly is of the general type above described and is provided with rectangular frame members, as described, the improved effect, whereby the object of the invention is obtained, results from connecting the opposite side members of each frame by strong wires, for example one for each row of springs, and wherein each wire is permanently secured, for example, by coiling one of its ends about one side member of the frame; then extending it longitudinally of a row of springs; and, while placing it under substantial tension, attaching its opposite end to the opposite side member of the frame as by coiling around said end member, so that said wire in the completed assembly is under high tension. This wire is connected to each of the several springs in the row, desirably at the point at which the endmost convolutions of juxtaposed springs are united to each other. Since this wire is under

initial tension and since it is of material highly resistant to tensile stress, any force tending to depress this wire at any point between its connections to the opposite side members of the frame is opposed by the resistance of the stiff frame members. Thus a load imposed upon any of the constituent springs of a row is resisted not only by the spring itself but by the stiffly resilient wire of the surrounding frame and also by the resistance of all of the springs in a row as transmitted to the suspension wire. This wire thus functions according to the same principle as the cable of a suspension bridge. The aforesaid arrangement, although very simple, is very effective in preventing undesirable local depression of the upper or supporting surface of the assembly.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a fragmentary plan view of a spring assembly embodying the present invention;

FIG. 2 is a fragmentary vertical section substantially in the plane of the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary elevation looking from the left-hand side of FIG. 1;

FIG. 4 is a fragmentary plan view, to larger scale, illustrating a desirable way of suspending a pair of juxtaposed spring coils from the tension member of the present invention; and

FIG. 5 is a small scale, diagrammatic plan view of a spring assembly according to this invention.

Referring to the drawings and in particular to FIG. 5, which diagrammatically illustrates a spring assembly in accordance with the present invention, the numerals **1, 2** and **3** designate coil springs arranged in one transversely extending row, while the numerals **4, 5** and **6** designate corresponding springs in the adjacent transversely extending row, the several rows of springs being arranged within a frame (FIG. 5) comprising the opposite end members **20** and **20***a* and the front and rear members **20***b* and **20***c*. This frame may desirably consist of stiff, carbon steel spring wire of a gauge, for example, of from No. 9 to No. 3 (American wire gauge), bent to rectangular form with rounded corners and with the ends permanently joined, for example at one end of the frame, by welding or soldering. Such a frame is highly resistant to deformation, as by the deflection of its opposite parallel members toward each other. As shown in FIG. 5, which is a plan view, the frame, comprising the members **20, 20***a*, **20***b* and **20***c*, is at the top of the spring assembly but as illustrated in FIG. 3, the spring assembly comprises a bottom frame, desirably like the top frame, the member **21** of this bottom frame corresponding to the member **20** of the frame shown in FIG. 5. According to prior practice, the upper and lower convolutions of the bordering spring coils may be connected to the front and rear members of the respective frames by a helical wire coil H (FIG. 1), said bordering coils thus supporting the frame.

Also in accordance with prior practice, for example as illustrated in the above patent to Levine, No. 2,197,131, adjacent coils in each row are connected together at their upper and lower ends while the coils of adjacent rows are similarly connected to each other. Thus, as illustrated in the patent just referred to, the uppermost convolutions of the coils of adjacent rows are connected by tie wires **11** of lesser gauge than the wires which form the frame, and these tie wires are so devised as not only to connect coils of adjacent rows but also to provide the connections between adjacent coils of the same row. One desirable mode of connecting the tie wires to the coils is shown in said patent. Thus, as shown in FIGS. 2 and 4, a given wire **11** is so bent as to form bights **10***a* and **10***b* which embrace the uppermost turns **1***x* and **2***x*, respec-

tively, of the adjacent springs **1** and **2**, so as to connect the latter springs, and since the tie wire **11** extends from one side of the spring assembly to the other, it thus serves to connect the coils of adjacent rows.

In accordance with the present invention, a tensioned suspension wire T has one end connected to the side member **20** of the frame, as by coiling it about said member and, if desired, by welding or soldering it to the member **20**, and extends across the entire width of the assembly and has its opposite end (FIG. 2) connected to the frame member **20***a* as by coiling it about said frame member and, if desired, soldering or welding it to the latter. Each of the wires T extends along a line defined by the axes of the several coils of a given row and it is connected to the springs constituting each pair of adjacent springs in any suitable manner, desirably with some provision for relative movement of the parts. Conveniently and desirably such connection is made by so bending the tie wire **11** so as to provide the latter with a third bight **11***m* (FIG. 4) through which the suspension wire T passes so that the upper convolutions **1***x* and **2***x* of the adjacent springs **1** and **2** for example, are suspended from the wire. The same connection is provided between the wire T and the upper convolutions of each spring of a pair of adjacent springs. Desirably, similar tensioned suspension wires T extend across the assembly above each row of springs and are connected to the several coils of each corresponding row.

In assembling the suspension wires T with the other parts of the assembly and after connecting one end of a given wire T to one of the frame members, the wire T is placed under strong tension and held under tension while it is being connected to the opposite member of the frame. Since the frames are stiff and resist bending, the tension wires are normally substantially straight and under substantial tension in the completed assembly, the frame members to which the ends of the wires are secured being stiffly resilient, and since these wires T are of high tensile strength and since their opposite ends are anchored to the frame, they strongly resist any force tending to depress them. Since the upper ends of the coils are secured to and in a sense suspended from these tensioned wires T, the depression of any given coil or of adjacent coils by a locally applied downward force is strongly resisted. Thus the entire upper surface of the assembly is maintained approximately flat even under substantial load. In this simple way such a spring assembly is greatly improved as respects its ability to maintain a substantially flat, horizontal upper surface even though loaded, although it is resilient, as respects the capability of the entire upper surface of the spring to be pressed down toward the lower surface.

While the particular means of connecting the suspension wires T to the frame, as well as the specifically described way of connecting the wires T to adjacent springs has been found desirable, it is to be understood that other means of connection, having an equivalent function, are to be considered as within the scope of the invention. Furthermore, although as here suggested the suspension wires T extend longitudinally of each row of spring coils, it is contemplated that they may be omitted, for example at alternate rows, or if additional resistance be desired, then that they may also be arranged between adjacent rows, although in the latter event they would not be connected directly to any individual spring. However, under such circumstances, it is contemplated that the suspension wire T might underlie the tie wires thus to give support to the latter.

It will be understood that in accordance with a preferred embodiment, the lower frame of the assembly will also be provided with wires like the wires T, for example, as shown at T^1 in FIG. 2. Such an arrangement permits the assembly to be used with either side up if desired, and also provides a very firm support for the spring assembly so that even though it may rest upon a surface which is not exactly horizontal, nevertheless the assembly as a whole provides a good foundation, for example, for supporting an inner-spring or other type of mattress.

The suspension wires are of high tensile strength, for example, high-carbon spring steel, desirably of a diameter greater than that of the tie wires, but somewhat less than that of the frame. It will be noted that the upper and lower convolutions of each spring are connected, at diametrically opposite points to one of the suspension wires, which, by reason of the stiffness of the suspension wire, tends to prevent tipping of the individual spring and so helps to maintain a flat surface.

While herein the invention has been described with particular reference to its embodiment in a bed spring, it will be understood that, except for a variation in dimensions, it may be embodied in assemblies for use in seat cushions of large or small size; likewise that the improved assembly may be used as an open or uncovered spring; or as the resilient element of a box spring or inner-spring mattress.

While in the drawings the assembly has been illustrated as comprising a relatively small number of coil springs, it is to be understood that assemblies of any dimension and having any desired number of coils are within the purview of the invention.

While a desirable embodiment of the invention has herein been illustrated and described by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the scope of the appended claims.

I claim:

1. A spring assembly of the kind wherein a plurality of rows of equal length, upright, coiled springs are attached to each other by their top and bottom convolutions, and wherein tie wires, extending transversely of the several rows, unite corresponding springs of the several rows, and wherein an upper, substantially rectangular, open frame, which is highly resistant to deformation, surrounds and is substantially coplanar with the top convolutions of the several springs and is connected to and supported by the border springs of said assembly, the assembly further comprising a substantially rectilinear lower frame to which the lower convolutions of the border springs are connected, characterized in having means, additional to the springs themselves, comprising a single suspension element for each individual row of springs which tends to maintain the entire upper surface of the assembly, as constituted by the collective upper convolutions of the constituent springs and the tie wires, flat and in a horizontal plane.

2. A spring assembly according to claim **1**, further characterized in that the means tending to maintain the upper surface of the assembly flat and in a horizontal plane comprises tensioned suspension elements connecting opposite parallel sides of the rectangular top frame to each other, said suspension elements being of material of a high tensile strength and being so connected at their opposite ends to the respective sides of the frame that they are normally under tensile stress, and means connecting the springs of each row to one of said suspension elements.

3. A spring assembly according to claim **1**, further characterized in that the lower frame is substantially identical in construction with the upper frame and in having suspension wires extending across the assembly between opposite side members of the lower frame, each respective suspension wire being connected to the lower convolutions of the springs of a corresponding row, and each of said suspension wires of the lower frame being normally under tension.

4. A spring assembly which comprises a plurality of parallel rows of juxtaposed spring coils and wherein the springs in one row are substantially aligned with corresponding springs in the next row, and the juxtaposed springs in one row are tied to the corresponding springs in the next row by tie wires which extend transversely of

the several rows and which connect the juxtaposed springs in the one row to the juxtaposed springs in the next row, said spring assembly comprising upper and lower, substantially rectangular open frames, each frame being highly resistant to deformation, one frame surrounding and being substantially coplanar with the top convolutions of the several springs and which is connected to the border springs of the assembly, and the lower frame being substantially coplanar with the bottom convolutions of the several springs and being connected to the lower convolutions of the border springs of the assembly, suspension wires extending longitudinally of each row of springs, both at the top and bottom of the assembly, said suspension wires being under strong tension and connected, at their opposite ends, to those parallel frame members, respectively, which extend along the opposite ends of the rows of the springs, each of said tie wires being substantially straight except for bights protruding at spaced regions thereof, one such bight engaging the end convolution of one coil spring of a pair, another bight engaging the end convolution of the other spring coil of a pair thereby uniting said convolutions, and a third bight embracing the tensioned suspension wire and thereby permanently connecting the suspension wire to said two adjacent springs.

5. A spring assembly comprising a plurality of rows of equal length, upright, coiled springs, upper and lower substantially rectangular, substantially rigid, open frames, each consisting of high-carbon spring steel wire of a gauge within a range of from 9 to 3 (American Wire Gauge), means connecting the upper and lower convolutions of adjacent springs in each row, and means connecting the upper and lower convolutions of juxtaposed springs in adjacent rows, and suspension wires, each connected, at its opposite ends, to those parallel frame members, respectively, which extend along the opposite ends of the rows of springs, each suspension wire being under strong tension and extending along one of the rows of springs, and means connecting diametrically opposite points of the end convolutions of each spring of a row to the corresponding suspension wire.

6. A spring assembly comprising a plurality of rows of equal length, upright, coiled springs, upper and lower substantially rectangular, substantially rigid, open frames, each consisting of high-carbon spring steel wire, means

connecting the upper convolutions of adjacent springs in each row, means connecting the lower convolutions of adjacent springs in each row, means connecting the upper convolutions of juxtaposed springs in adjacent rows, means connecting the lower convolutions of juxtaposed springs in adjacent rows, and suspension wires, each connected, at its opposite ends, to those parallel members respectively of the upper frame, which extend along the opposite ends of the rows of springs, each suspension wire extending along one of the rows of springs, and means connecting diametrically opposite points of the end convolutions of each spring in said row to the suspension wire, the suspension wires being under strong tension.

7. A spring assembly which comprises a plurality of parallel rows of juxtaposed spring coils and wherein the springs in one row are substantially aligned with corresponding springs in the next row, and the juxtaposed springs in one row are tied to the corresponding juxtaposed springs in the next row by tie wires extending transversely of the several rows and which connect the juxtaposed springs in the one row to the juxtaposed springs in the next row, suspension wires extending longitudinally of each row of springs, both at the top and bottom of the assembly, means providing an anchorage for each end, respectively, of each suspension wire, each such wire being under strong tension, each of said tie wires being substantially straight except for bights protruding at spaced regions thereof, one such bight engaging the end convolution of one coil spring of a pair, another bight engaging the end convolution of the other spring coil of a pair thereby uniting said convolutions, and a third bight embracing the tensioned suspension wire and thereby permanently connecting the suspension wire to said two adjacent springs.

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