July 27, 1954 H. C. FLINT ET AL 2,684,844

SINUOUS TYPE OF SPRING WITH VARIABLE LENGTHS OF TRANSVERSE AND LONGITUDINAL BARS

Filed May 31, 1952

3 Sheets-Sheet 1

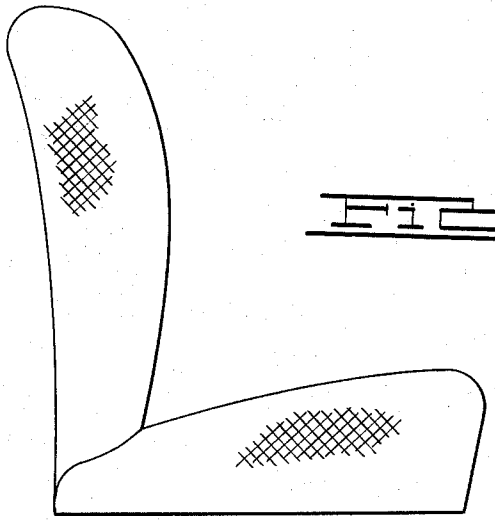

Fig. 1.

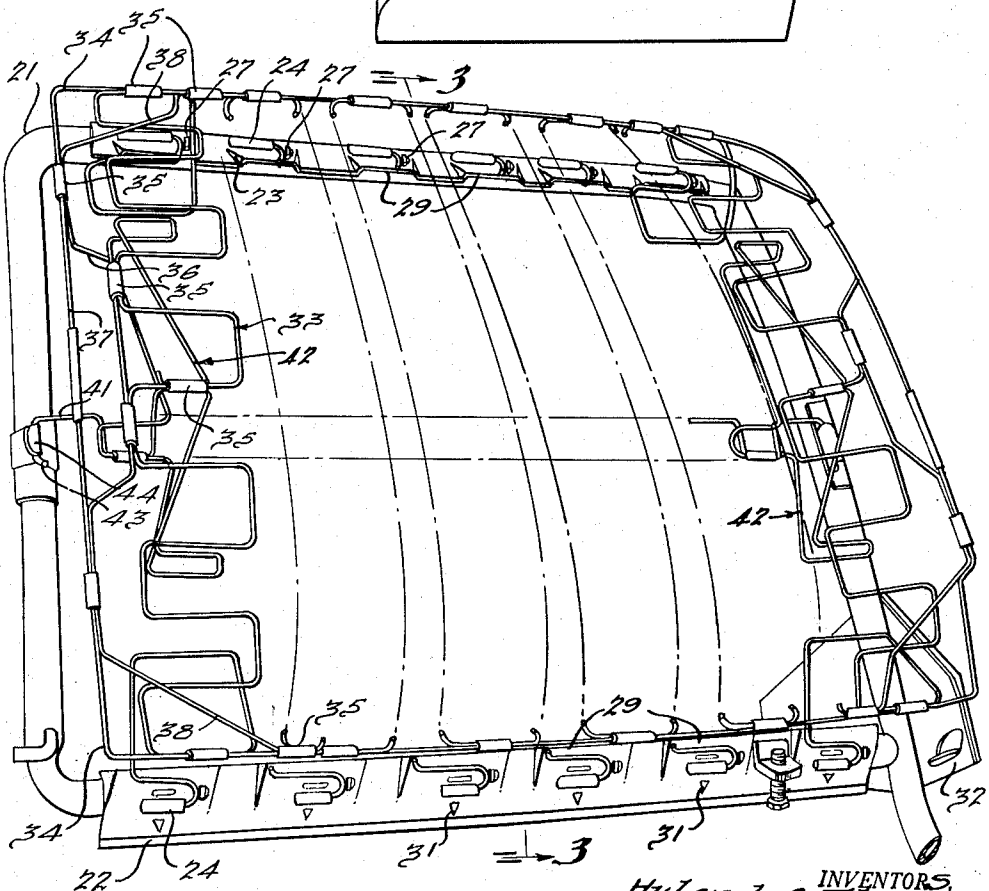

Fig. 2.

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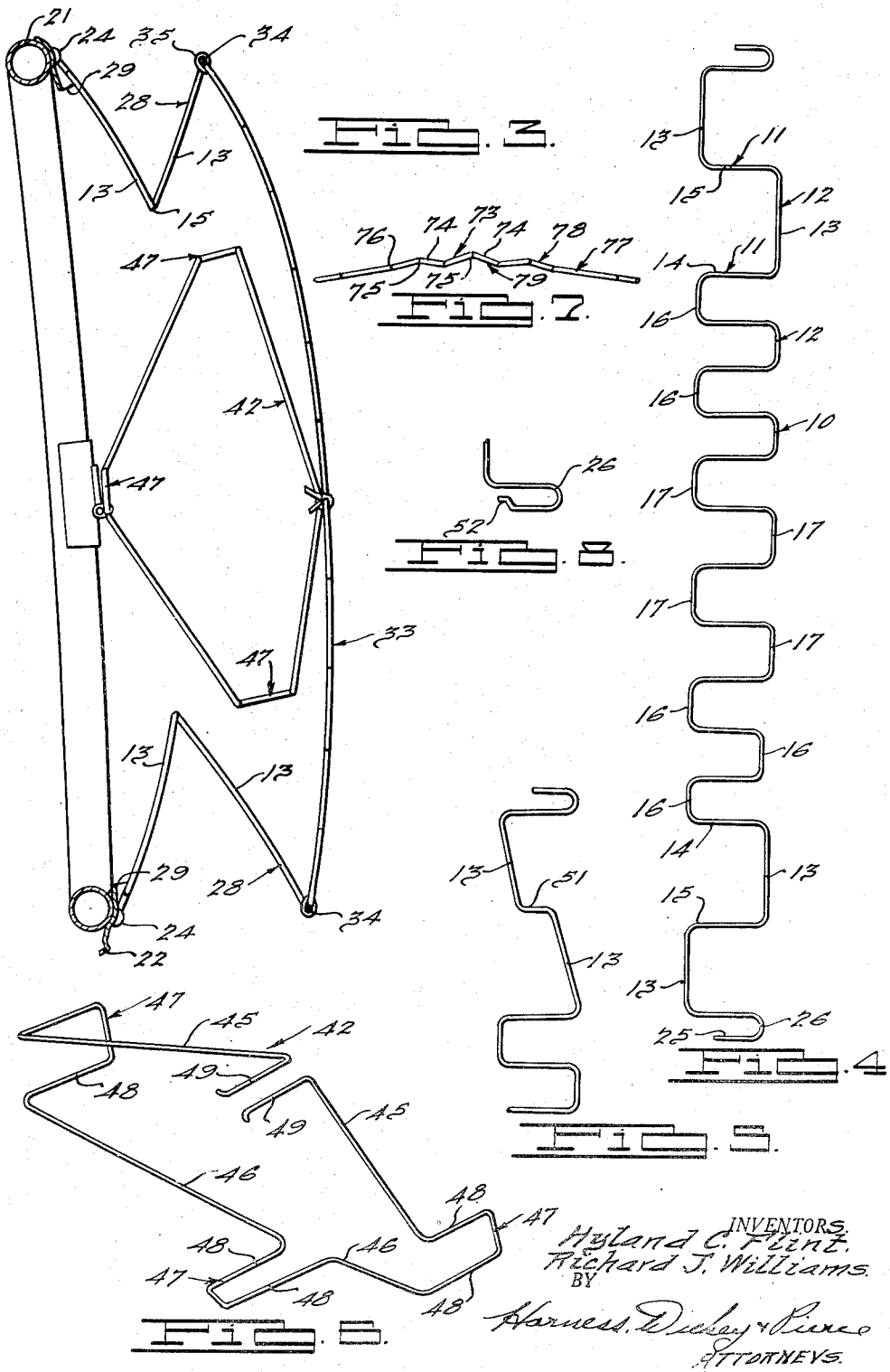

Fig. 3.

Fig. 7.

Fig. 8.

Fig. 4.

Fig. 5.

Fig. 6.

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Filed May 31, 1952 3 Sheets-Sheet 3

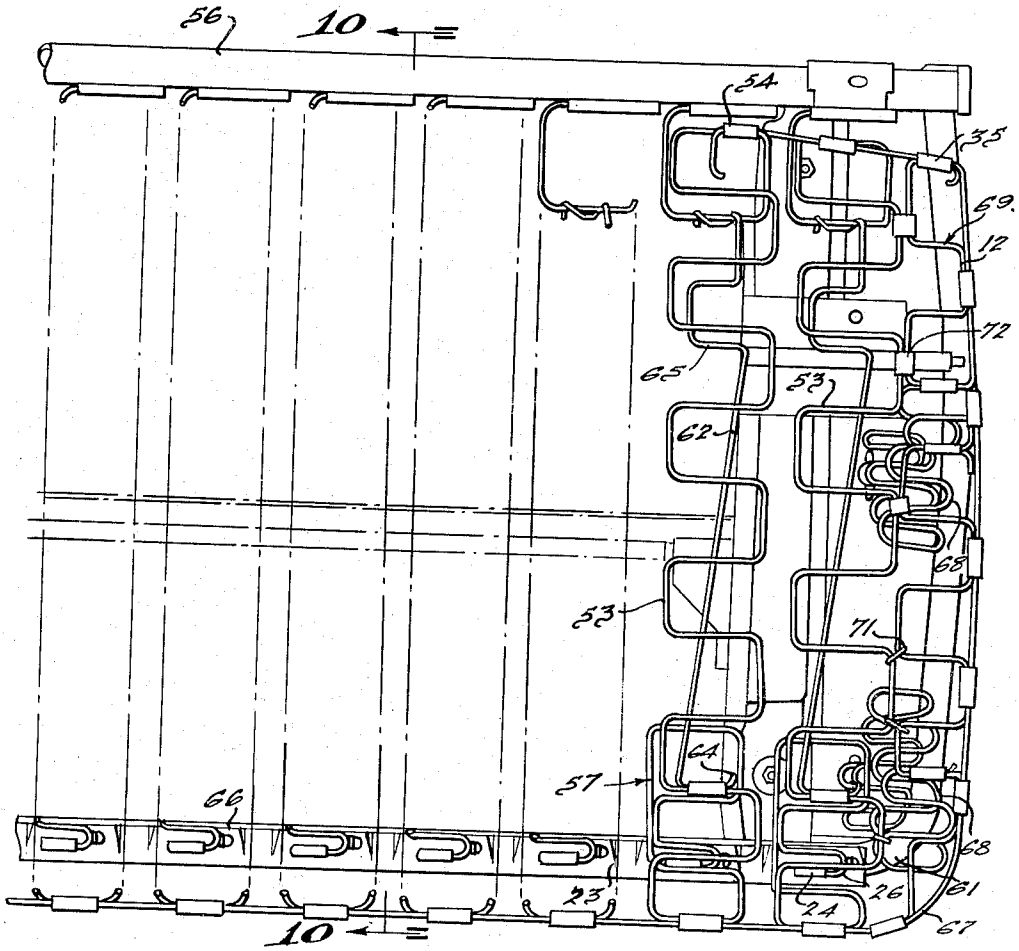

FIG. 9

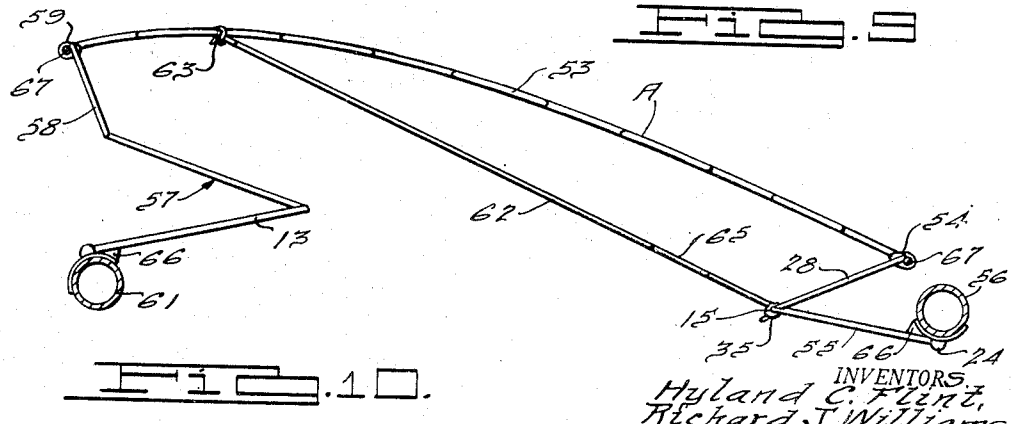

FIG. 10

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SINUOUS TYPE OF SPRING WITH VARIABLE LENGTHS OF TRANSVERSE AND LONGITUDINAL BARS

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9 Claims. (Cl. 267—1)

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This invention relates to springs and spring assemblies, and particularly to a variable type of sinuous spring strip and assemblies constructed therefrom.

Heretofore in the art it has been the custom to construct spring strips from wire which is bent back and forth to provide straight portions joined by oppositely disposed loops, which is preferably arched to a predetermined radius to provide resistance against deflection when the ends are drawn out and secured to a frame. In seat cushions a predetermined contour must be obtained to provide the proper comfort with pressures distributed over the supported load to meet the requirement of the occupant. In the back cushion the pressure distribution must be such as to provide maximum support for the small of the back of the occupant. Difficulty has been experienced when attempting to shape the uniform type of spring strip to produce such contours and provide the proper distributed pressures on the load.

To overcome this difficulty, a new type of spring strip has been developed, based upon a different concept from that embodied in the uniform strips. The spring strip of the present invention is made of wire bent into sinuous form of a nonuniform construction. The straight bars are maintained parallel but are spaced different degrees apart in different sections throughout the spring strip length. This spacing is controlled by spacing bars which are straight portions in alignment at each edge of the spring strips. The theory embodied in this spring construction resides in the use of the torsion bars for controlling the loading and contouring of the spring strip. When the bars are closer together, the section of the spring strip is weaker than when the bars are spread farther apart, at which section the spring strip is stronger. Since the main load of the seating supporting portion of a spring is substantially two thirds from the front edge of the assembly, which we may call the A point, then at this point the torsion bars will be farther apart. At the forward portion of the spring, which might be considered the leg engaging portion, where the load is substantially reduced over that at the A portion, the torsion bars are much closer together and thereby produce less pressure on the legs of the occupant. In one arrangement, the spacer

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bars may be considered contouring bars and these will deflect conforming to the contour produced by the load upon different portions of the spring strip controlled by the spacing of the torsion bars, as pointed out above. In a second arrangement, some or all of the spacing bars are arched or centrally bent to form a truss to provide additional strength thereto, the amount of which conforms to the degree of bend provided in the spacer portions. The formation of the spacer bars produces an arc in the resulting strip which aids the strip to resist downward deflection.

The load supporting section of the spring strip is supported on wire portions at one or both ends which are formed into V shape, the single lengths of wire acting upon the single torque bar disposed therebetween to provide the desired support for the end of the load supporting section. Where height is desired at the forward end of the seat assembly, a substantially vertically disposed spacer bar is employed to provide height, but in no way interfering with the operation of the adjacent end supporting wire portion. At the end of the wire portions, an attaching loop is provided which is similar to the loops employed in the uniform type of spring strip, so that such end may be attached to the retaining elements heretofore designed and invented for the uniform type of spring strip. It is to be understood that other end portions may be provided for other types of retaining elements, but at the present time the looped ends operate satisfactorily in the present available retaining elements.

Accordingly, the main objects of the invention are: to provide a spring strip having selected sections in which the torsion bars of the strip are spaced different amounts apart; to provide different load supporting characteristics in a spring strip with bars maintained parallel and joined at the ends by aligned spacing bars of different lengths; to form a wire sinuous type of spring strip having aligned spacing bars at the edges joined by parallel torsion bars, with the spacing bars of different length at different sections of the strip to space the torsion bars different amounts to obtain a predetermined load characteristic to the load supporting portion of a spring strip; to support the ends of the load supporting portion of a spring strip by straight

wires disposed in V formation joined by a torsion bar, with the free end thereof formed into a loop for securing the ends of the strip in a retaining element; to form a sinuous spring strip with parallel torsion bars of substantial length joined by spacing bars of different lengths to reduce the length of wire in the spring strips and the number required in the spring assembly; to bend the spacing bars in truss formation to provide an arcuate shape to the length of spring strip and to strengthen the bars; to support the central section of the load supporting portion of the spring strip by oval-shaped spring elements of predetermined form having deflecting arms joined by torsion bars; and, in general, to provide spring strips and spring assemblies which are simple in construction and economical of manufacture.

Other objects and features of novelty of the invention will be specifically pointed out or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a view in side elevation of a seat formed of a seat and back cushion embodying separate spring assemblies covered by upholstery material;

Fig. 2 is a perspective view in elevation of a spring assembly forming the seat back of Fig. 1;

Fig. 3 is an enlarged, sectional view of the structure illustrated in Fig. 2, taken on the line 3—3 thereof;

Fig. 4 is a plan view of a spring element after the wire is formed into sinuous form and before having the ends bent to form the V supporting portions;

Fig. 5 is a broken view of structure, similar to that illustrated in Fig. 4, showing a further form of the invention;

Fig. 6 is a perspective view of a helper spring employed in the spring assembly illustrated in Figs. 2 and 3;

Fig. 7 is an edge view of structure, similar to that illustrated in Fig. 4, showing a further form thereof;

Fig. 8 is a broken view of the structure illustrated in Fig. 4, showing a further form of spring construction;

Fig. 9 is a broken plan view of a seat cushion formed from a spring strip, similar to that illustrated in Fig. 4, and

Fig. 10 is a sectional view of the structure illustrated in Fig. 9, taken on the line 10—10 thereof.

Referring more specifically to Figs. 1 to 5, a spring element 10 is illustrated made of wire bent back and forth to provide a plurality of parallel torsion bars 11 joined by aligned spacer bars 12 at alternate opposite points along the length of the strip. It will be noted in this construction that the spacer bars 13 at the end form the V supporting portion when bent into V relationship by twisting the torsion bars 14 and 15. The section of the strip intermediate the torsion bars 14 forms the load supporting portion of the formed spring unit through the resistance to twist of each length of torsion bar. It will be noted that certain of the spacing bars 16 are of different length from other spacing bars 17. By employing the shorter bars 16, the torsion bars 11 are spaced closer together and thereby produce a weaker section in the spring strip than the torsion bars 11 which are spaced further apart by the longer spacing bars 17. Because of the greater spacing of the torsion bars, greater resistance to twisting is offered for a unit length and a greater load may be supported for the same degree of deflection as when the bars 11 are placed closer together. When a length of spring is designed for a back cushion wherein the main load supporting area is substantially centrally of the top and bottom frame members, the central portion of the spring strip has the spacing bars 17 of the greatest length and thereby is capable of supporting a greater load.

In spring strips now being manufactured and sold in the trade, the torsion bars were placed close together and uniformly spaced throughout the length of the strips. This required unusual formations and added elements to be employed to obtain only approximate contouring and load supporting characteristics. By selectively spacing the torsion bar, the spring strip of the present invention produces the proper contouring and the desired supporting characteristics at all points throughout the load bearing area. The spring strips having the uniformly spaced bars throughout the length were limited to substantially 1⅞" in width. The spring strip herein described may have a width of 2¾" when made of the same gauge of wire. Because of this extra width, the number of spring strips employed in the half back unit illustrated in Fig. 2 is reduced to six from the eight spring strips required when the old type spring strip was employed. Similarly, while the old type of spring strip employed in a seat cushion was 1⅞" in width, the new type of spring strip has a width of 3", the gauge of wire being the same. The new spring produces a more accurate contour and more desirable load supporting characteristics while reducing the number of spring strips from 19 to 16. Thus, in the present type of spring, the length of wire employed is substantially reduced and is of greater width for the same gauge of wire, reducing the number of spring strips required to cover the area of a frame. Further, the spring strip produces accurate contours and desired load supporting characteristics when the assembly is occupied.

Referring more particularly to Figs. 2 and 3, one section of seat back spring assembly is illustrated for an automobile of the two-door type in which each section may hinge forwardly. In this arrangement, a frame 21 of any type, herein illustrated as made of tubing, is of substantially rectangular form, having a spring strip and trim supporting stamping 22 welded or otherwise secured to the bottom frame member, while a similar stamping 23 is welded or otherwise secured across the top of the frame. Both of these stampings are provided with spaced tunnels 24 for receiving the end 25 of a loop 26 provided at each end of the spring strip. The loop ends 26 are the form employed in the known type of spring, so that the strips may be mounted in the same manner in the various types of receiving and supporting elements provided therefor. Upstanding tabs 27 are provided at the open end of the tunnel for preventing the outward movement of the loop end after the end has been assembled in the tunnel and rotated into the position illustrated. The spring strips, as pointed out hereinabove, have the straight portions 13 at each of the ends disposed in V-relationship at 28 by twisting the torsion bars 14 and 15 to provide a set therein, with the portions 13 in angular relation, as illustrated in Fig. 3. It will be noted in Fig. 3 that a ledge 29 is provided inwardly of each tunnel 24, spaced from the lower arm 13 to permit the end 25 to pivot in the tun-

nel a slight amount and the lower arm 13 to deflect until it strikes the ledge 29 to thereby provide initial softness to the assembly. The lower portion of the stamping 22 is provided with pressed-out tongues 31 to which the upholstery material is secured in the usual manner. A side shield 32 is mounted at each end of each half unit for contouring the upholstery when the spring assembly is trimmed.

After a plurality of formed spring elements 33 are secured across the frame 21, a border wire 34 is secured to the end torsion bars of the load supporting area by bands 35. Filler braces or arch elements 36 are secured to the side portion 37 of the border wire and to certain of the adjacent spacer bars 12 by the bands 35. The ends 38 of the elements 36 extend at an angle at the corners and are secured to the top and bottom portions of the border wire 34 by bands 35.

Spanning the side members of the frame 21 medially between the top and bottom members thereof is a supporting web 41 made of wire formed in series of convolutions, having like spacer bars throughout its length to form a support for central bracing elements 42. The ends 43 of the web 41 are hooked over tabs 44 which are welded or otherwise secured to the side members of the frame. The reinforcing elements 42, as illustrated in Fig. 6, are made of wire having deflecting arms 45 at the top and arms 46 at the bottom. U-shaped portions 47 are provided at the junction of the arms 45 and 46 and between the junction of the two arms 46. The U-shaped portions incorporate torsion bars 48 which control the deflection of the arms 45 and 46 in combination with the deflection produced by the arms themselves. The adjacent ends of the arms 45 are extended outwardly at 49 to form attaching means by which the arms are secured to the same or different torsion bars 11 of the formed spring elements 33 by the bands 35. One of the torsion bars 48 of the loop 47 between the arms 46 is secured to one of the spacing bars of the web 41 by the bands 35, as illustrated in Fig. 2. In this manner, the reinforcing element 42 reinforces the load supporting portion of the formed spring elements 33 near the central portion thereof. When desired, the plurality of formed spring elements 33 may be interconnected in a suitable manner by a flexible strip extending thereacross, or by hog rings securing adjacent portions of each of the spring elements to each other in a conventional manner.

In Fig. 5, a modified form of the end portion of the element is illustrated, that wherein the arms 13 are disposed at an angle to reduce the length of the torque bar 51 to increase the strength thereof, to thereby provide further support for the arms 13 of the V-shaped ends 28 of the formed spring elements. By shortening the bar, the resistance to twisting is substantially increased, as pointed out hereinabove, and by lengthening the bars the resistance to twisting is substantially decreased. Thus, by lengthening the bars and placing them closer together, a weaker section in the load supporting portion of the spring is obtained. It will be noted in Fig. 8 that the end loop 26 of the spring strip has the end offset at 52, which is desired when other types of clips or supports are provided for the spring strip ends to prevent the spring from moving out of the clip or supporting element.

Referring to Fig. 7, a section of a spring strip 73 is illustrated, constructed of wire bent into sinuous form to be similar to the spring strips

illustrated in Figs. 4, 5 and 9. In addition, the spring strip 73 has certain or all of the spacing bars 74 thereof bent angularly by deflecting the central portion 75 outwardly from the adjoining torsion bars 76. This shapes the spacing bars as truss elements which resist bending and thereby provides greater strength against deflection of the spring strip and at the same time provides a predetermined arcuate shape thereto. It will be noted that certain of the spacing bars 77 are left straight while other spacing bars 78 are only slightly bent as compared to additional spacing bars 79 which are bent at a greater angle. It is to be understood, however, that all of the spacing bars 74 may be bent a like amount or variable amounts and that a portion only of the bars need be so bent.

It will be noted from the above discussion that when the torsion bars are spaced closer together and the spacing bars thereby shortened, a weaker section of the spring is provided by reducing the load applying torsion to individual bars and that the weakness is maintained by retaining the spacer bars straight so that they may bend under load. When the torsion bars are spaced a greater distance apart to provide greater load supporting characteristics to resist deflection, the spacer bars are longer and therefore weaker. By bending the spacer bars, particularly the longer ones where strength is desired, greater support is provided to the area supporting the greater load. By varying the degree of this truss formation, greater strength is provided to the formed strip at the point where a greater load is to be supported. The arching of the spacer bars provides an additional variable to that of lengthening or shortening the spacer and torque bars to control the characteristic of the formed spring strip, not only controlling its contour and load supporting characteristics but also its rate and amount of jiggle.

Referring to Figs. 9 and 10, a seat cushion spring assembly is illustrated embodying a load supporting portion 53 of a formed spring element which is similar to the spring element 33 illustrated in Fig. 4. The load supporting portion 53 has the rear end 54 thereof supported on a V portion 26, the same as illustrated in Fig. 3, with the exception that the lower arm 55 thereof is secured in a tunnel 24 on the under side of the frame member 56 so that the arm 55 may pivot downwardly therefrom when supporting a load. A similar V portion 57 is provided at the front of each spring strip portion 53 joined to the end 59 thereof by a spacer bar 58. The spacer bar 58 increases the height of the front end of the load supporting portion 53, otherwise it has little or no function in the deflection of the element. A bracing rod 62, similar to that illustrated and described in the copending application to Flint, Serial No. 170,901, filed June 28, 1950, and assigned to the assignee of the present invention, is employed with the element. The bar 62 has a straight end portion by which it is attached to the torque bar 15 of the V-shaped supporting end portion 28 by a band 35. The opposite end thereof has a pigtail end 63 which is connected to a torsion bar 11 adjacent to the front end of the load supporting portion 53. The rod 62 may have an offset portion 65 therein which permits the bar to elongate but which resists the elongation thereof with a predetermined force. The bar 62 controls the deflection and contour of the element when loaded, dividing the element into two spring portions. The ends of the spring elements are provided with loops 26

which extend within tunnels 24 in the stamping 23 which is secured to the front and rear frame elements. Ledge portions 66 are provided in the stampings which prevent the deflection of the lower arm 13 of the end portion 57 at the front of the spring element and which prevent the arm 55 at the rear of the elements from moving upwardly but permit it to deflect downwardly under load. After a plurality of the formed spring elements are secured across the frame, a border wire 67 is secured about the edges of the springs at the side, front and rear edges by the securing bands 35. At the sides the border wire is secured to the spacing bars 12, while at the forward and rearward ends the border wire is secured to the end torsion bars 54 and 59 of the load supporting portions. Additional support may be provided at the side and front corner portion of the assembly by the zigzag type of wire strip bent in V formation and secured to the frame and endmost spring strips.

It will be noticed that the endmost springs 69 have the torsion bar portions thereof reduced substantially in length from that of the main spring elements to thereby increase the strength of the strips at the sides of the assembly. In this arrangement, the endmost springs are secured to the border wire and act as the arch or filler element of the spring assembly.

When desired, the spring elements may be secured together in the conventional manner, such as by hog rings 71 or bands 72, or, as pointed out hereinabove, a flexible strip may be secured across the entire spring assembly at one or a plurality of points from the forward to the rear portion thereof. In this arrangement, it will be noted that the torsion bars are closer together near the front and the rear of the assembly both sides of a portion substantially two-thirds from the forward end of the spring where the bars are spaced farther apart. This is the point where the greatest load is applied to the supporting area, requiring greater strength in the spring elements. This point, indicated at A, is located at substantialy two-thirds of the length of the spring strip measured from the front edge thereof.

In either of the spring element assemblies, the spring elements are so constructed as to form a predetermined contour when loaded, controlled by the length of the spacing and torque bars and by the shape of the spacing bars. When the spacing bars are straight and in aligned relation, they will deflect under load and asume the contour produced by the distributed load. In other words, the supporting bars provide resistance by deflecting under load while the torsion bars support the load by the degree of twist applied thereto. Further strength is provided to the spacing bar by the arch bent therein at the point required to support the greater load.

What is claimed is:

1. A spring strip made of wire bent back and forth into sinuous form having straight lengths of edge spacing bars joined to parallel transverse straight lengths of torsion bars providing adjacent oppositely presenting square-shaped loops of different widths depending on the length of the spacing bars, and a loop at the rear end of the strip extending therebelow and forwardly thereof, said loop having extending means connected to said strip for reinforcing said strip.

2. A spring strip made of wire bent back and forth into sinuous form having straight lengths of edge spacing bars joined to parallel transverse straight lengths of torsion bars providing adjacent oppositely presenting square-shaped loops of different widths depending on the length of the spacing bars, a loop at the rear end of the strip extending therebelow and forwardly thereof, and a bracing rod secured to the end of said loop at the end of the strip and to the forward portion of said strip.

3. A spring strip made of wire bent back and forth into sinuous form having straight lengths of edge spacing bars joined to parallel transverse straight lengths of torsion bars providing adjacent oppositely presenting square-shaped loops of different widths depending on the length of the spacing bars, a loop at the rear end of the strip extending therebelow and forwardly thereof, and a bracing rod secured to the end of said loop at the end of the strip and to the forward portion of said strip, said bracing rod having one end extended transversely of the length thereof and helically formed to receive the transverse bar to which the end is secured.

4. A spring strip for a seat having a main load bearing area made of a wire bent back and forth into a sinuous form providing straight lengths of edge spacing bars joined at substantially right angles to parallel transverse torsion bars the spacing of which is controlled by the length of the spacing bars, which lengths are varied to conform to the load to be supported by the spring strip in order to produce a predetermined desired contour in the strip under load, said strip conforming when loaded to said predetermined contour which is produced by the variable spacing and twisting of said torsion bars and the lengthwise deflection of certain of said spacing bars.

5. A spring strip made of wire bent back and forth into sinuous form providing edge spacing bars which are straight in a plane lengthwise of said strip and which are joined to parallel transverse torsion bars the spacing of which is controlled by the length of the spacing bars, which lengths are varied to conform to the load to be supported by the spring strip to produce a predetermined desired contour of the strip under load, certain of said spacing bars being bent intermediate the ends thereof to provide a crown to the length of the strip.

6. A spring strip as set out in claim 5 wherein said certain of said spacing bars are so bent as to provide two straight portions disposed in angular relation to one another.

7. A spring seating strip made of wire bent back and forth to provide straight lengths forming bendable spacing bars joined to parallel transverse torsion bars, the torsion bars resisting deflection by twisting, the spacing bars providing contour and resisting deflection by bending, the ends of at least the majority of said torsion bars being perpendicular to a pair of substantially parallel spaced planes in which the spacing bars joining said torsion bars substantially lie, certain of said spacing bars being bent in said planes to assist in providing contour for said strip.

8. A spring feeding strip as set out in claim 7 wherein said bent spacing bars have straight portions in angular relation to each other, and wherein some of said bent spacing bars have the straight portions thereof disposed in greater angular relation to each other than others.

9. A spring strip made of wire bent back and forth into sinuous form having straight lengths of edge spacing bars joined to parallel, transverse straight lengths of torsion bars providing adjacent oppositely presenting square-shaped loops

of different widths depending on the length of the spacing bars, said wire so formed forming a seating load bearing area of the resulting spring, and a loop at the rear end of the strip extending therebelow and forwardly thereof, said loop having extending means connected to said strip for reinforcing said strip.

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