Oct. 17, 1950 R. J. WILLIAMS ET AL 2,526,183

SINUOUS SPRING CUSHION ASSEMBLY

Filed March 18, 1949 3 Sheets-Sheet 1

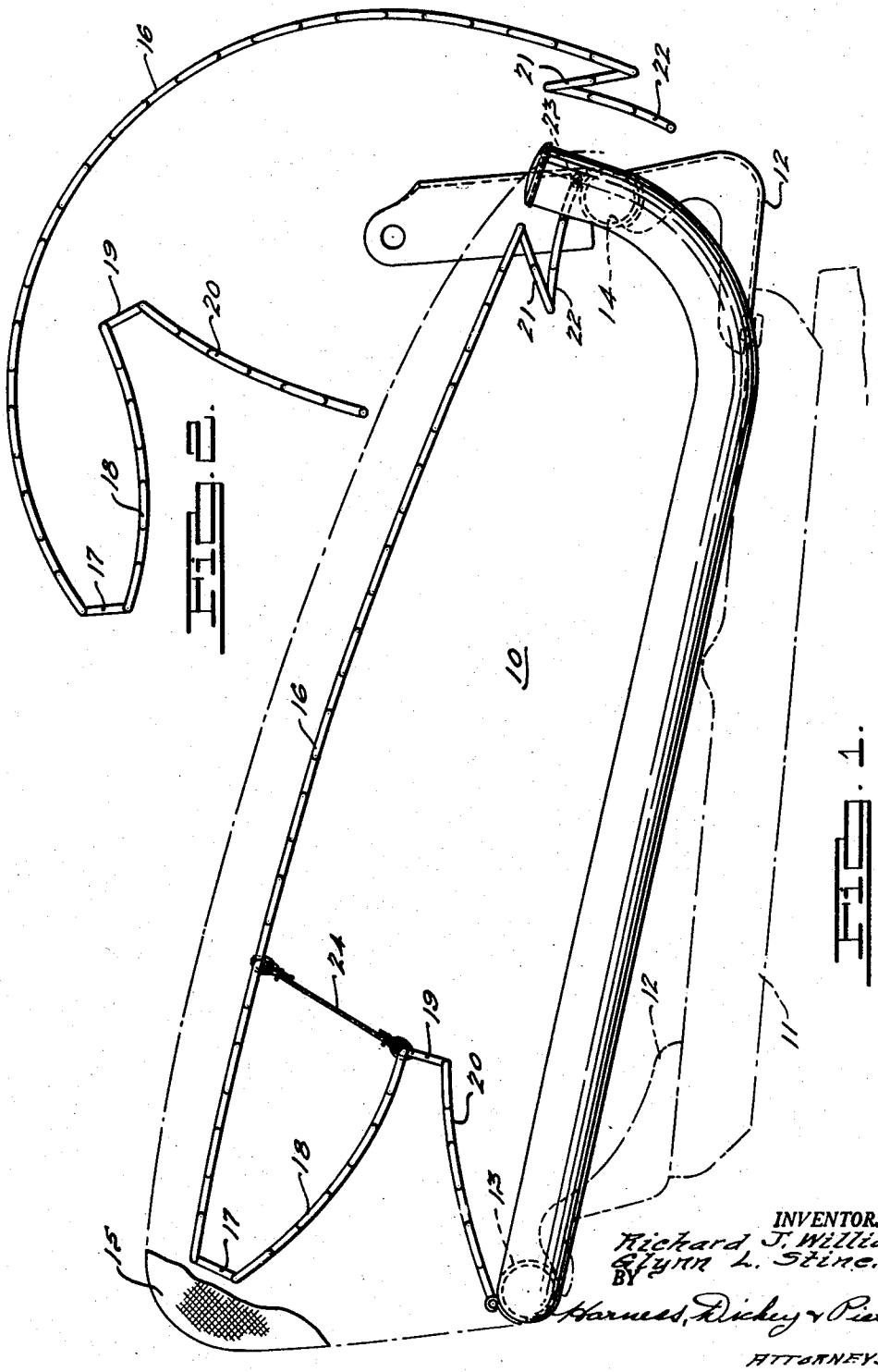


Fig. 2.

Fig. 1.

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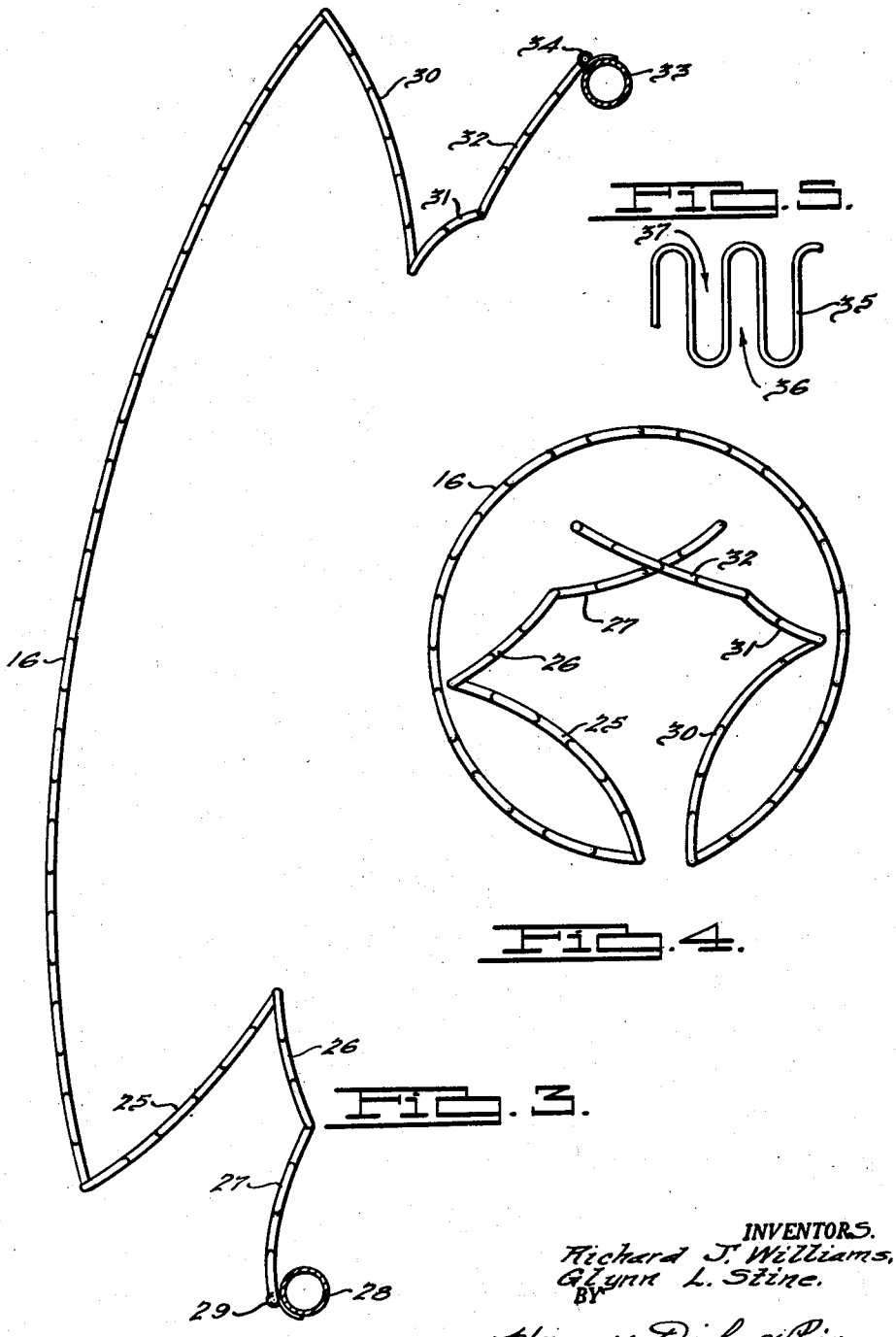


FIG. 5.

FIG. 4.

FIG. 3.

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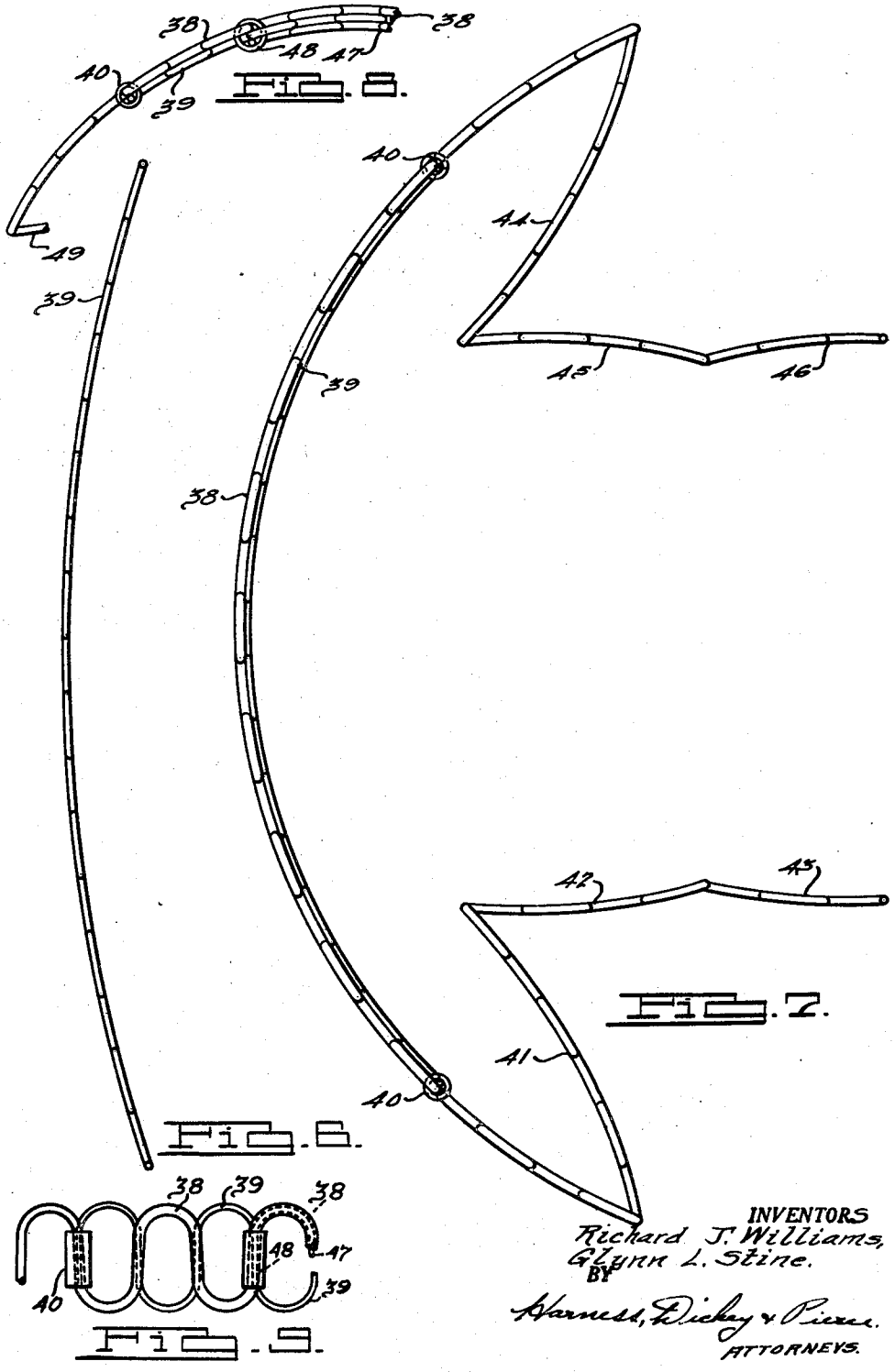


Fig. 5.

Fig. 7.

Fig. 6.

Fig. 9.

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SINUOUS SPRING CUSHION ASSEMBLY

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This invention relates to springs and particularly to sinuous springs for use in cushions and the like and having a predetermined arcuate set therein and supporting ends formed in predetermined angular and arcuate relation.

The spring strip of the present invention is similar to that of Nicholas Wolofski, Serial No. 16,671, filed March 24, 1948, and assigned to The Murray Corporation of America, and under which the assignee of the present invention has certain rights. Specifically, the spring is made of wire bent back and forth to form a series of oppositely disposed loops, a plurality of such loops forming a load-bearing section and a plurality of such loops forming end supporting sections of the spring strip.

There have been described in the above-identified copending application spring strips having their supporting ends bent beneath the load-bearing section in a manner to provide a resilient support for the latter. We have now found that particular advantages of contour and position of the load-supporting section of the spring relative to the spaced frame elements on which the ends are secured results from the particular shape of the end section.

Accordingly, the main objects of the invention are: to provide a spring strip which deflects under a load to produce a desirable contour in the load-supporting section of said spring strip; to provide supporting end sections in a spring strip which contribute to the forming of such a desirable contour in addition to contributing resiliency to the spring assembly; to provide a supporting end section for a sinuous spring strip, which end section includes an arcuate portion having a curvature substantially the same as that of the load-bearing section; to provide a sinuous spring strip with supporting ends made up of three curved sections bent in predetermined angular relation to each other and to the load-supporting section; to provide a spring strip having on one end a reversely and a forwardly curved extending portion joined to the spring and to each other by vertically disposed loops; to provide a spring having on one end thereof an arcuate section reversely bent with respect to the load-bearing section and a curved section reversely bent with respect to said first section, the latter curved section being substantially parallel to the load-supporting section and the point of attachment of said curved section to a frame element being at a point beyond the end of the load-supporting section; to provide a spring strip having on each end a curved section reversely bent with respect

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to the load-bearing portion and a second curved section bent in the direction opposite the first section, the latter section having an angularly extending end portion; to provide a load-bearing section preformed into substantially a complete circle in order to provide, when said load-bearing section is extended for attachment to spaced frame elements, an arc of predetermined curvature and tension; and to provide a helper spring for the load-bearing section.

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 vertical view of a seat frame supporting a spring strip which embodies features of the present invention;

Fig. 2 is a view of the spring strip illustrated in Fig. 1 before being attached thereto;

Fig. 3 is a sectional view of spaced frame elements having a spring strip attached thereto embodying features of the present invention;

Fig. 4 is a view of the spring strip illustrated in Fig. 3 before attachment to the spaced frame elements;

Fig. 5 is a broken plan view of the spring strip illustrated in Figs. 1–4 inclusive;

Fig. 6 is a view of a sinuous helper spring;

Fig. 7 is a view of a spring strip having a helper spring incorporated therein;

Fig. 8 is a fragmentary view illustrating an alternative use of helper springs; and

Fig. 9 is a plan view of the structure illustrated in Fig. 8.

Referring more particularly to the drawings:

Fig. 1 illustrates diagrammatically a seat frame 10 having a base portion 11, structural supports 12, a front frame member 13, a rear frame member 14, and a fabric cover 15. The sinuous spring consists generally of a front supporting end, a rear supporting end, and a load-supporting section shown as an arched portion 16 of large diameter.

The front support section includes, as shown, a vertically disposed single loop section 17 and an arcuate section 18 angularly disposed to said single loop and having substantially the same degree of curvature as the load-supporting section. The arcuate section 18 is curved reversely to the load-supporting section 16. A second vertically disposed single loop portion 19 is angularly disposed to the curved section 18, and a second arcuate section 20 is angularly disposed to the

single loop portion 19. The second arcuate section 20 is fastened by suitable means to the front frame member 13. The arcuate section 20, like the arcuate section 18, has substantially the same degree of curvature as the load-bearing section 16 and, further, is substantially parallel therewith.

It is not necessary that the parallelism between the arcuate end section 20 and the load-bearing section 16 be one of geometric rigor, since their exact relationship will vary somewhat between a position at rest and positions with various deflections under load. However, as indicated, these two sections 16 and 20 bear a substantially parallel relationship to each other.

The rear support section, as shown, consists of a substantially straight section 21 angularly disposed to and bent beneath the load-supporting section 16 and an arcuate section 22 angularly disposed to said straight section 21. The arcuate section 22 has substantially the same curvature as the load-bearing section 16 and is positioned substantially parallel therewith. The arcuate end section 22 is attached to the rear frame member 14 at a point 23 which is positioned beyond or rearwardly of the end of the load-supporting section. In a preferred embodiment of the invention, the point 23 lies substantially in an arc extended from the arc described by the load-bearing section 16. In this latter embodiment there is secured an advantageous spacing between the end of the load-bearing section and the frame elements.

A strap 24 with one end attached to the load-bearing section of the spring strip and the other end attached to a section of the front end support assists in maintaining the arc set of the load-bearing section and the spatial relationship of the respective spring portions.

Fig. 2 illustrates the spring strip of Fig. 1 in its relaxed state; that is, prior to its being extended for attachment in the frame elements. The curvature of the load-bearing section 16 has a much smaller diameter in its relaxed position. The spring strip is made in this predetermined form in order to put the load-supporting section 16 under a predetermined tension when extended into its functional position.

It should be noted that the arcuate portion 18 is substantially parallel with the load-bearing section 16 when the spring strip is relaxed, whereas extension and deflection of the spring strip tend to bring the arcuate portion 20 into parallel relationship with said load-bearing section.

Fig. 3 illustrates an alternative embodiment of the invention and shows, in particular, a plurality of arcuate end sections. The front end section includes, as shown, an arcuate portion 25 angularly disposed relative to the load-bearing section 16 and being curved reversely thereto. A second arcuate section 26 is angularly disposed relative to the arcuate section 25 and is curved reversely thereto. A third arcuate section 27 extends outwardly from the second arcuate section 26 and is curved similarly thereto.

The three arcuate sections 25, 26, and 27 have a curvature which is substantially equal to that of the load-bearing section, and the third arcuate section 27 is positioned substantially parallel to said load-bearing section. The supporting end of the spring strip is attached by suitable means to the frame element 28 at the point 29. As shown, the point 29 is positioned beyond the end of the load-bearing portion 16 in accordance with a preferred embodiment of the invention.

The rear support section illustrated in Fig. 3 is quite similar to the front support section. An arcuate spring section 30 is angularly disposed relative to the load-bearing portion 16 and is curved reversely thereto. A second arcuate section 31 is angularly disposed relative to the arcuate section 30 and is curved reversely thereto. A third arcuate section 32 extends outwardly from the end of the second arcuate section 31 and is curved similarly thereto. The arcuate section 32 is attached to the frame element 33 at the point 34. Each of the three arcuate spring sections 30, 31, and 32 has a curvature substantially the same as the curvature of the load-bearing portion 16.

Fig. 4 illustrates the spring strip of Fig. 3 in its relaxed state. Further, Fig. 4 illustrates a preferred predetermined form of the load-bearing section to be used to best advantage with the end supporting sections of the present invention. As shown, the load-bearing section 16 of the spring strip forms a substantially complete circle in its relaxed state. In this form, the spring strip, when it is extended, is under a tension tending to force the load-bearing section 16 into a substantially complete circle.

Again it should be noted that, although the arcuate spring portions 25 and 30 are each substantially parallel with a portion of the load-bearing section 16, extension and deflection of the spring strip tend to bring the arcuate portions 27 and 32 into parallel relationship with said load-bearing section. Where two reversely curved sections, e. g., 25 and 16 in Fig. 4, are stated to be substantially parallel, it should be noted that the parallelism is again not one of geometrical rigor but rather refers to the general position of the sections as would be defined by chords, one of which subtends the arc in the end section and the other of which subtends an arc of equal length in a corresponding portion of the load-bearing section. The drawings indicate, in general, the degree of "parallelism" which in each illustrated case results in a desirable contour of the deflected load-bearing section.

Fig. 5 is a plan view of a small section of the spring strip of the invention and consists of a wire 35 bent back and forth to form a series of alternately opposed loops; for example, loops 36 and 37.

Figs. 6 and 7 illustrate an embodiment of the invention in which a somewhat more yieldable load-bearing section 38 is combined with an end-supporting section having arcuate portions.

In particular, Fig. 6 shows a helper spring 39 which is adapted to coact with a load-bearing of a spring strip. The helper spring is illustrated in the form of an arcuate spring strip of comparatively smaller gage than is normally used in spring strips for automobile cushions and the like. For example, the helper spring 39 may be formed from 11½ gauge wire, whereas the wire used in the remainder of the spring strip assembly may be formed from 13 gauge.

The manner of using the helper spring 39 is illustrated in Fig. 7 wherein it is shown lying beneath the load-bearing section 38 and contiguous through its entire length with said load-bearing section. The helper spring is secured to the load-bearing section by any suitable means, such as by hog rings 40.

As shown in Fig. 7, the front end-supporting section consists of an arcuate portion 41 extending inwardly beneath the load-bearing section 38, a second arcuate portion 42 angularly disposed

to the first arcuate portion **41**, and a third arcuate portion **43** angularly disposed to said second arcuate portion.

The rear end-supporting section, as shown in Fig. 7, similarly consists of three arcuate portions **44**, **45** and **46** in angular relationship with each other and extending inwardly beneath the load-bearing section **38**.

The spring strip of Fig. 7 is shown in its relaxed position, and is adapted to be extended for attachment within a frame element in a manner similar to that illustrated in Fig. 3. Whereas the tension of the spring strip of Fig. 3 tends to force the load-bearing section into the form of a substantially complete circle, the tension of the load-bearing section **38** of the spring of Fig. 7 will be comparatively small in the extended state. Even in its relaxed state the latter spring includes a load-bearing section of large diameter.

In this manner, the invention contemplates the use of a comparatively hard, or load-resisting, load-bearing section (Figs. 3 and 4) and a comparatively soft or yieldably load-bearing section (Fig. 7), wherein deflection of desirable curvatures is secured.

A helper spring of the type described makes possible the effective use of a straight or flat, load-supporting section. As shown in Fig. 7, the end portions **41**, **42**, **43**, **44**, **45** and **46** have substantially the same curvature as the load-bearing section and the portions **41** and **44** lie substantially parallel with the load-bearing section **38**. When, however, the spring strip is extended for attachment within a frame element, the end portions **43** and **46** are pulled outwardly to become substantially parallel with the load-supporting section **38**.

Although end-supporting sections having a plurality of arcuate portions are preferred in the embodiment of the invention which includes a load-bearing section in combination with a helper spring, the latter combination in itself and independently of the type of end-supporting sections provides an improved means for securing a more desirable curvature of the load-supporting section under load.

The helper spring may be preformed in a variety of arcuate sets and, likewise, may be flat. Further, the helper spring may be attached to the load-bearing section in a manner such that both springs are concave downwardly, or the springs may be attached in a manner such that the load-bearing section is concave downwardly and the helper spring is concave upwardly. The final shape assumed by the attached springs will depend somewhat on the length of the helper spring, the diameter of its arcuate set, the gauge wire used in its manufacture, the number of helper springs used, and the part of the load-bearing section to which they are attached. For example, it is possible to attach near the front end of the load-bearing section a helper spring which is concave downwardly and with an arcuate set of diameter less than the arcuate set of the corresponding portion of the load-bearing section. A second helper spring, being concave upwardly, may be attached to the rear portion of the load-bearing section with sufficient tension to flatten out the load-bearing section, or even to reverse its curvature. In this manner, the load-bearing section of the spring strip may be formed in a manner to be convex upwardly in one portion and concave upwardly in another. In this connection, it will be apparent that an arcuate helper spring beneath a straight load-bearing section will tend to arc the latter. Conversely, a helper spring having an arcuate set with a diameter greater than the arcuate set of the load-bearing section will tend to flatten out the latter.

Figs. 8 and 9 illustrate an alternative method of using helper springs. In this embodiment, a plurality of helper springs lie contiguously with each other. In the figure, the load-bearing section **38** of a spring strip has attached to its underside by means of the hog ring **40** a helper spring **39**. A second helper spring **47** is attached beneath the first helper spring by means of the hog ring **48**. A fragment of the end supporting section **49** extends beneath the load-bearing section. In this manner a refinement of the shape and tension of the load-bearing section of the spring strip may be obtained.

The helper spring strip may be any desired length and, as stated above, is preferably formed from a wire of smaller gauge than the wire of the load-bearing section. Variations in the gauge of the wire, the diameter of the arcuate set, the length of the helper spring and the number of the helper springs introduce a flexibility of design to meet a wide variety of load conditions. Similarly, the particular curvature and position of portions of the end-supporting section relative to the load-bearing section contribute to the securing of particular advantages of contour and position of said load-bearing section relative to the frame elements to which the supporting ends are attached.

We claim:

1. A sinuous spring strip preformed in a relaxed state and adapted to be extended for attachment in a frame element and including an arcuate load-bearing section; an end-supporting section which includes an arcuate portion having, when said spring strip is extended, a curvature substantially the same as that of the load-bearing section and said end supporting section being adapted to be attached to the frame element at a point lying below and beyond the respective end of the load-bearing section.

2. In a zigzag spring strip, a load-bearing section, a helper zigzag spring strip lying along and being contiguous along its entire length with said load-bearing section and having its ends secured thereto, and end-supporting sections disposed angularly to and extending beneath said load-bearing section.

3. In a spring cushion construction, spaced front and rear frame members, a plurality of zigzag spring strips extending across said members with the end portion secured thereto, the portion of each spring strip near the rear frame member having a double reverse bend to provide a deflecting end to the spring strip interjacent the ends thereof near the rear supporting end whereby the double reversely bent portion of each spring strip may deflect a substantial amount forwardly of the end portion which is secured to the rear frame member.

4. In a spring cushion construction, spaced front and rear frame members, the rear frame member being elevated to provide a foot access opening to the space beneath the rear portion of the seat a plurality of zigzag spring strips extending across said members, said spring strips having a load supporting portion and at the rear end an attaching portion offset from the end of the load supporting portion and extending below and beyond the end thereof, and means for securing the strips across the frame members with the rear end portion of the attaching por-

tion secured to the elevated rear frame member in such manner that the end of the load supporting portion above the attaching portion may freely deflect downwardly forwardly of the attached end portion of the attaching portion, and a downwardly extending portion at the front end of the load supporting portion secured to the front frame member, said downwardly extending portion being of greater depth than said offset attaching portion at the rear end.

5. In a sinuous spring strip made of wire bent into zigzag form including when unsupported an arcuate load-bearing section, an end supporting section offset therefrom which includes an arcuate portion having a curvature substantially the same as that of the load-bearing section and positioned substantially parallel therewith and extending beyond the end thereof, and an integral angularly disposed portion of the strip joining said sections and extending beneath the end of the load-bearing section.

6. A sinuous spring strip made of wire adapted to be attached to frame elements of a cushion assembly, said spring strip comprising a load-bearing section consisting of an arc of large diameter along the longitudinal length of the strip, one end of said load bearing section being reversely bent for a short length beneath the end and again bent beneath said first reversely bent portion and extended a greater distance than said short length to extend beyond the said end of the load-bearing section and substantially parallel thereto.

7. A sinuous spring strip made of wire adapted to be attached to frame elements of a cushion assembly, said spring strip comprising a load-bearing section consisting of an arc of large diameter along the longitudinal length of the strip, one end of said load-bearing section being reversely bent for a short length beneath the end and again reversely bent beneath said first reversely bent portion and extended a greater distance than said short length to extend beyond the said end of the load-bearing section, the extension of the last said reversely bent end portion beyond said end of the load-supporting portion being greater than the spacing of said end of the load-supporting portion from the second said reversely bent end portion.

8. In a sinuous spring strip, an arcuate load-bearing section, a helper spring strip lying along and being contiguous along its entire length with said arcuate load-bearing section and being secured thereto, and a V-shaped end-supporting section extending beneath one end of said load-bearing section and disposed adjacent to one end of said helper spring.

9. In a spring cushion construction, spaced front and rear frame members, the rear frame member being elevated to provide a foot access opening to the space beneath the rear portion of the seat, a plurality of zigzag spring strips extending across said members, each said spring strip having a load supporting portion and at the rear end an attaching portion offset from the end of the load supporting portion and extending below and beyond the end thereof, and means for securing the strip across the frame members with the rear end portion of the attaching portion secured to the elevated rear frame member in such manner that the end of the load supporting portion above the attaching portion may freely deflect downwardly forwardly of the attached end portion of the attaching portion, and a downwardly extending portion at the front end of the load supporting portion of greater depth than said offset attaching portion at the rear end secured to the front frame member.

10. In a spring cushion construction, spaced front and rear frame members, a zigzag spring strip extending across said frame members, said spring strip having a load supporting portion and having at the rear end an attaching portion, one end of which extends below the adjacent end of the load supporting portion, the opposite end of which extends therebeyond, means for securing the end portion of the extended attaching portion to the rear frame member, means for securing the opposite end of the spring strip to the front frame member, the end of the load supporting portion above the attaching portion being free to deflect downwardly forwardly of and independently of the secured end portion thereof.

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