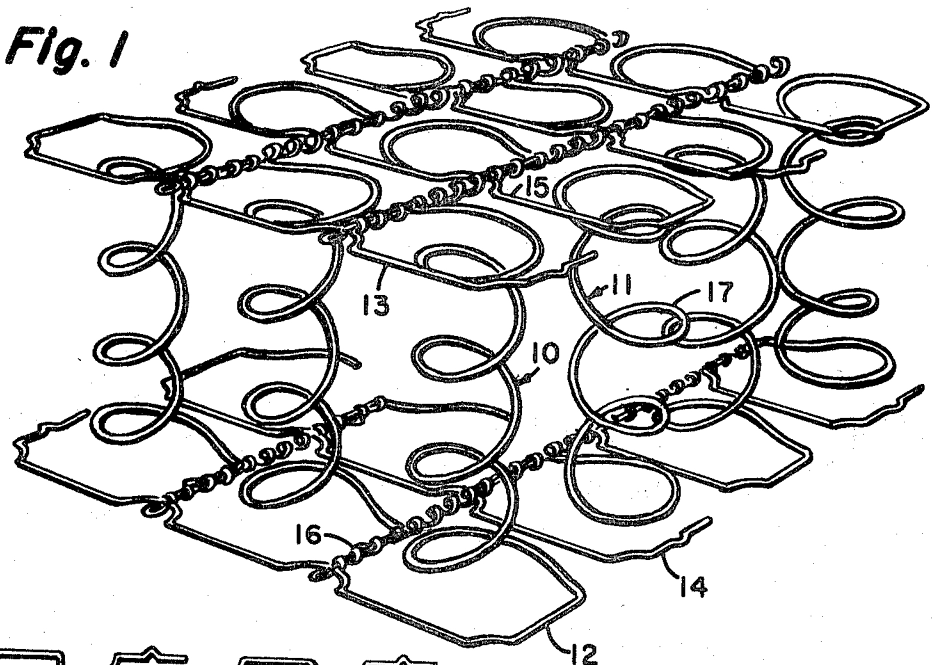
Oct. 13, 1970 K. KARPEN 3,533,114

COIL SPRING CONFIGURATION

Filed July 12, 1968 2 Sheets-Sheet 1

Fig. 1



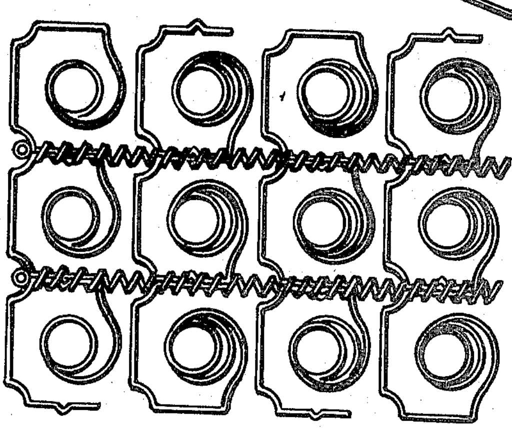


Fig. 2

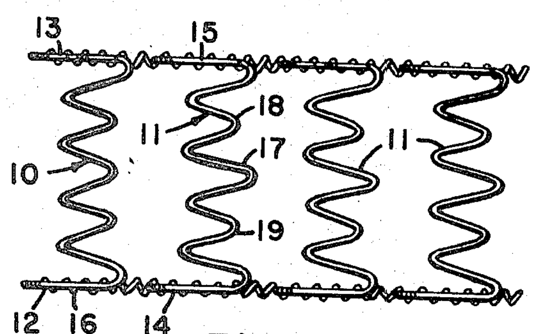


Fig. 3

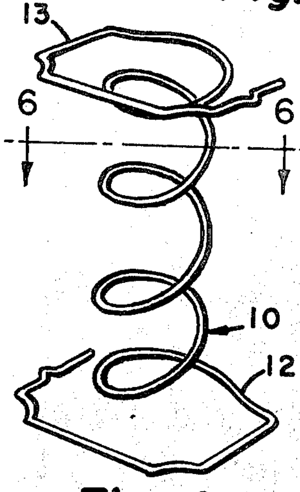


Fig. 4

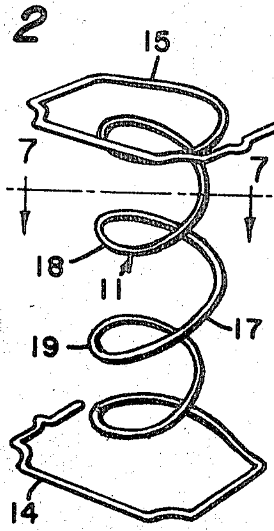


Fig. 5

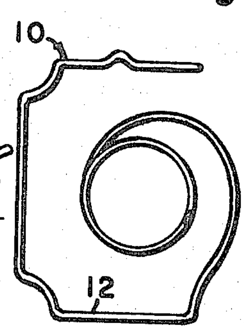


Fig. 6

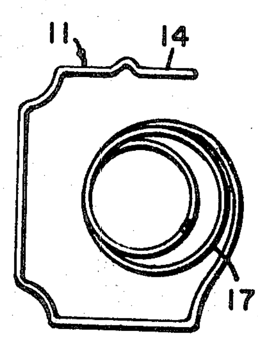


Fig. 7

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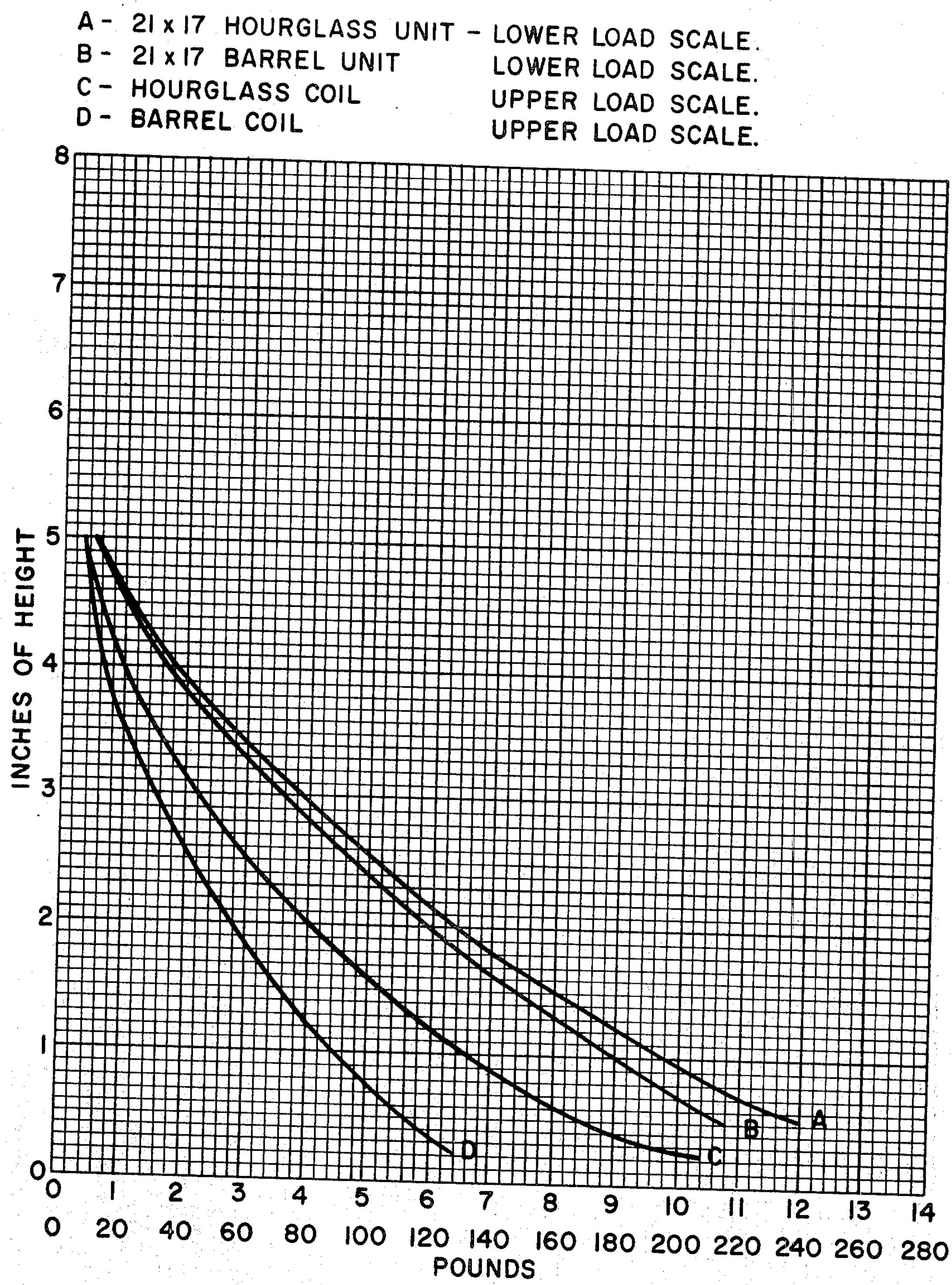

Fig. 8

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3,533,114
COIL SPRING CONFIGURATION

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U.S. Cl. 5—351 3 Claims

ABSTRACT OF THE DISCLOSURE

A coiled compression spring having an enlarged center coil in conjunction with standard expanded end coils for improved resilience, and a mattress spring unit using these coils in combination with standard coils.

BACKGROUND

Mattresses owe most of their comfort characteristics to the resilience of an assembly of compression springs. These springs are parallel, and have their ends interengaged to form a generally rectangular structure of a thickness equal to the axial length of the coils. Similar types of spring assemblies, although usually on a smaller scale, are commonly used in seating and bed structures. It is common practice to form the end coils of these compression springs at an enlarged circumscribed diameter with respect to that of the coils that are axially inward from the end coils. The enlarged end portions make it possible to interengage the ends to form the spring assembly, and also contribute to the stability of the spring so that compression does not result in buckling. Standard end-configurations have been developed that facilitate the interengagement of springs either by clips, or by small-diameter open-wound wire helices that are automatically rotated into a position interengaging the spring ends by assembly equipment that has been developed for this purpose. The securing of the spring ends along a substantial length of a straight section of wire though being embraced by the helices provides a very high degree of stability for the individual coils.

The standard compression spring that has been in common use for this type of spring assembly has incorporated an hourglass configuration, in which the enlarged ends are considered together with the smaller central coils to produce an appearance somewhat suggestive of an hourglass. The smaller central coils are not only stabilized by the enlarged end coils, but tend to move into the central space defined by the end coils as the compression of the spring approaches the "shut height," in which the spring is supposedly compressed into essentially a coplanar condition.

A primary prerequisite of spring assemblies that are to be used in mattresses is a particular type of resilience that seems to lend itself to a commonly-accepted sense of comfort. The so-called "spring constant" of the individual coils is the predominant factor in determining the resiliency characteristics of the entire assembly. This constant is the mathematical statement of the ratio of the amount of deflection of the spring with respect to the applied forces tending to compress it. A high degree of spring resilience would result in the application of substantially uniform pressure over the body of a person supported on a mattress, without concentrating the forces on the particular areas of a person's body that tend to enter most deeply into the mattress. Ideally, a spring unit should have enough stiffness to support a person without giving him the feeling of being immersed too deeply in a surrounding mass of softness, and yet be soft enough so that his body could assume a natural condition in a horizontal position which is comparable to the alignment

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of his body structure when standing. This necessarily requires that portions of the hips and shoulders must be resiliently received by the mattress so that supporting pressue can be applied to the remainder of the body in a relatively uniform intensity.

SUMMARY OF THE INVENTION

The present invention provides an increased resilience of the spring coils, without sacrifice of spring stability, by enlarging the central coil area of an otherwise conventional coil spring. The resulting configuration has been termed barrel-shaped. The generally conical configuration at the opposite ends of the spring produces a stability characteristic which is not interferred with by enlarging the central coil. In fact, the stability seems to be increased, as the buckling action characteristic of the enlarged entral coil seems to be less pronounced. This action, together with the increased resilience resulting from the larger amount of wire in the central coil, provides an over-all resiliency characteristic that represents a considerable improvement over the standard spring configuration. The development of this art has been so intense over so many years that any detectable alteration of spring constant in the direction to increase comfort is a significant improvement.

This invention also provides an assembly of coil springs in which the peripheral coils are of the standard hourglass configuration, and may be of substantially constant circumscribed diameter along the axial length between the end portions. The coils in the inner rows are formed with the enlarged central coil, and the decreased central circumscribed diameter of the peripheral coils makes it possible to minimize the interference between the springs and the surrounding upholstery that is normally associated with mattress construction. The entire assembled unit is then capable of deflecting with less abrasion between the spring coils and the padding, while retaining the resiliency characteristics of the expanded middle coils in the inner areas of the mattress that are primarily associated with the support of the occupants.

DESCRIPTION OF THE DRAWINGS

The several features of the invention will be analyzed in detail through a discussion of the particular embodiment illustrated in the accompanying drawings. In the drawings:

FIG. 1 is a perspective view of a section of a mattress spring unit incorporating this invention.

FIG. 2 is a plan view of the structure shown in FIG. 1.

FIG. 3 is a side elevation of the structure shown in FIG. 1.

FIG. 4 is a view of one of the peripheral coils of the unit shown in FIG. 1.

FIG. 5 is a view of one of the inner coils of the unit shown in FIG. 1.

FIG. 6 is a view on the section on the plane **6—6** of FIG. 4.

FIG. 7 is a view on the plane **7—7** of FIG. 5.

FIG. 8 is a graph showing the resiliency characteristics of individual coils and spring assemblies.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The spring assembly shown in FIG. 1 is composed of a peripheral row of springs **10** and a group of inner springs **11**. Both types of compression springs have the end portions **12–13** and **14–15** of enlarged circumscribed diameter with respect to the coils that are axially inward and immediately adjacent to these end portions. The enlargement of the end portions provides the straight sections that are interengaged by the helical locking wires **16**, which are rotated and advanced along their own axes to embrace the straight sections of adjacent coils. This type of assembly is and forms no part of the present invention.

The periphral coils **10** have a central portion of substantially constant circumscribed diameter. In other words, the coils that are axially inward from the end portions could be received within a cylinder with approximately the same clearance around the outside all along the length of the central portion, until the area approaching the end portions is reached. This type of coil is used in the assembly provided by the present invention in order to maintain a clearance space inward from a plane defining the peripheral edge of the entire spring assembly so that upholstery and padding may be received in this area without substantial interference from the spring coils as the mattress unit deflects under load.

The central area of the mattress, where the resiliency characteristics are of primary importance, is defined by a group of springs formed with enlarged central coils, as is the spring **11** shown in FIG. 1. The circumscribed diameter around the central coil **17** is greater than that of the coils **18** and **19** which are axially adjacent to the central coil **17** on opposite sides. The other springs **11** in the inner area of the assembly shown in FIG. 1 are all formed in this configuration. It is possible that some of the increase in spring stability of this formation results from a change in the effective column length of the spring which is subject to buckling. This has not yet been fully determined, and probably amounts to a tendency rather than an outright change of an entire characteristic. It should be noted that the tolerances encountered in the formation of springs and spring assemblies of this type will inevitably result in some of the central coils being disposed somewhat eccentric with respect to the approximate axis of the entire spring, and the coils are shown in this manner in FIG. 3. Even under these conditions, however, the spring stability seems to be effectively maintained.

FIG. 8 shows the comparative resiliency characteristics of the two types of spring configurations. The curve labeled A represents a test spring assembly 21 inches by 17 inches, constructed entirely of the standard spring configurations shown in FIG. 4 (hourglass). The curve C shows the resilience of a single coil of this type. The curve B shows the resilience characteristics of a test assembly of the same size, with the peripheral coils being of the FIG. 4 type, and the inner coils of the FIG. 5 (barrel) configuration. The D curve shows the characteristics of an individual coil of the FIG. 5 configuration. The free unloaded height of the individual coils is somewhat in excess of the 5 inches which represents the beginning point on the curve of FIG. 8. The slight variation in the coils will result in striking an average in the unloaded height, and the load characteristics at this point represent an average of the several coils involved. For a more representative reading, the curves are begun at the first point at which load was applied during the test. Similarly, the test results are terminated before the complete shut height of the springs was reached. At about the point indicated on the chart, there appears to be sufficient interference between the coils to render the reading somewhat misleading. Nevertheless, the curves in between the limits within which the tests were conducted illustrate the improved resiliency characteristics of the FIG. 5 configuration. All of the coils were made of a steel wire of approximately .072 inch in diameter, and of a material commonly used in springs of this type. Comparing the C and D curves, it will be immediately obvious that a particular load will produce a considerable increase in deflection on the FIG. 5 configuration over that of the FIG. 4. Utilizing the FIG. 4 in the outer areas will therefore tend to move the occupant of the mattress toward the center area without increasing the wire diameter. An opposite tendency would cause the occupant of a mattress to roll off the edge as soon as he approached it. If it is determined, for example, that each spring should contribute approximately 4 pounds of resistance in the central area of a mattress, it will be obvious that the FIG. 5 coil configuration can be deflected to a greater extent without exceeding this resistance, and can thus accommodate more easily the body configuration of the occupant. This characteristic is somewhat less obvious in the test of the entire spring units represented by the A and B curves, which show the results of the compression of the entire test assembly to the same height measurements over the full surface of the assembly. Nevertheless, it is still clear that a given load will produce a greater deflection at the same wire diameter, without producing instability and erratic curve configurations, when the FIG. 5 coils occupy the assembly with the exception of the peripheral row of springs using the FIG. 4 configuration.

I claim:

1. A spring assembly containing a plurality of coiled compression springs disposed on substantially parallel axes, and having the ends thereof substantially coplanar and interengaged to form a resilient body, each of said springs having end portions of enlarged circumscribed diameter with respect to the coils axially immediately adjacent thereto, wherein the improvement comprises:

a selected group of said plurality of springs having the axially central coil thereof formed at an increased circumscribed diameter with respect to that of the axially adjacent coils on both sides thereof, said central coils being laterally independent of the central coils of adjacent springs, and disposed within the axially-projected conformation of the ends of said springs.

2. An assembly as defined in claim **1**, wherein said springs with central coils having increased circumscribed diameter are disposed in the central portion of said assembly.

3. An assembly as defined in claim **2**, wherein a row of coils having relatively small central coils with respect to those of adjacent inner springs defines at least one edge of said assembly.

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U.S. Cl. X.R.

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