No. 840,027. PATENTED JAN. 1, 1907.

A. STUCKI.

VOLUTE SPRING.

APPLICATION FILED MAY 17, 1906.

FIG. 1

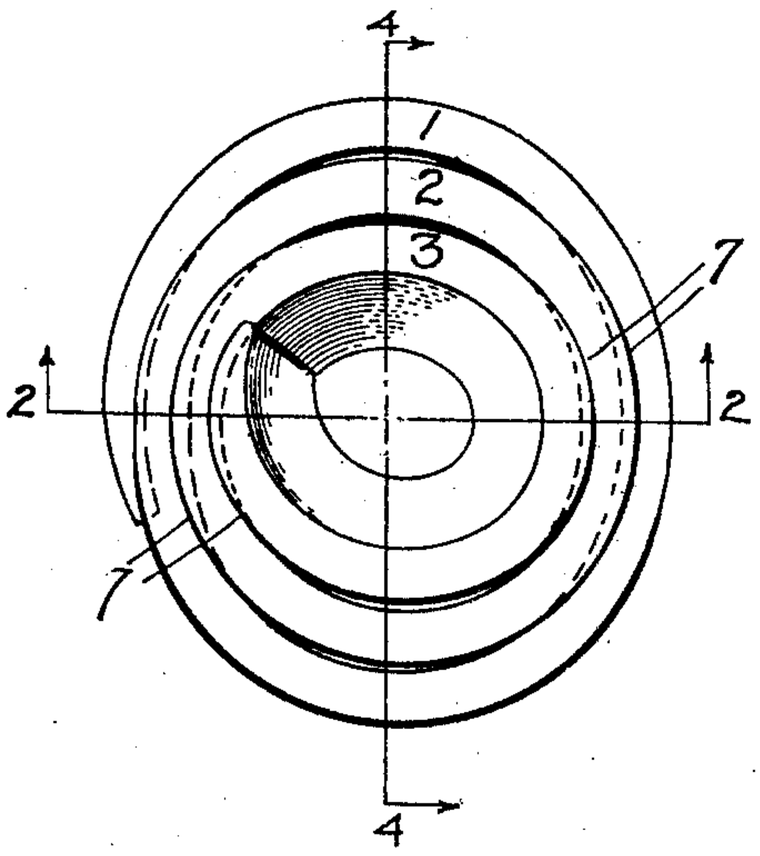
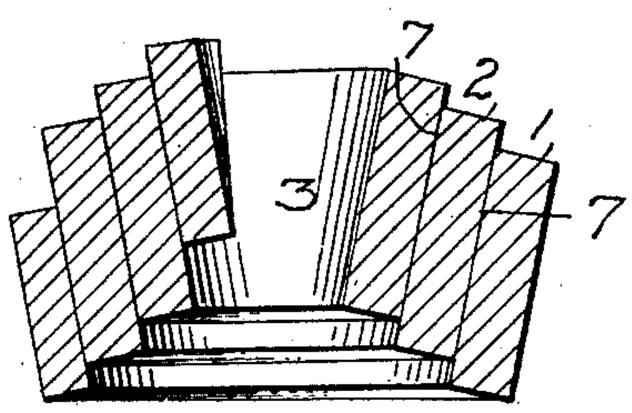
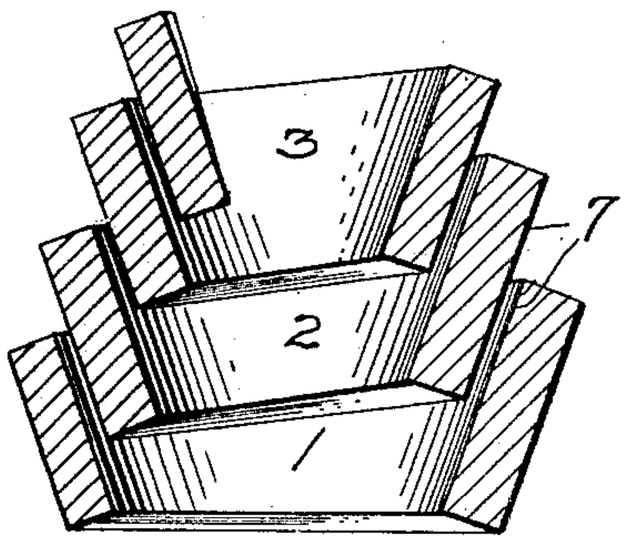


FIG. 3





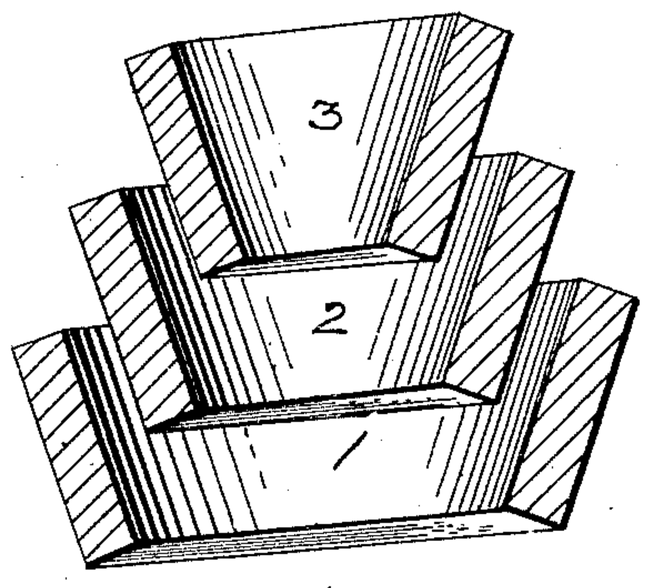


FIG. 2

FIG. 4

WITNESSES.

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VOLUTE SPRING.

No. 840,027. Specification of Letters Patent. Patented Jan. 1, 1907.

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To all whom it may concern:

Be it known that I, ARNOLD STUCKI, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Volute Springs; and I do hereby declare the following to be a full, clear, and exact description thereof.

This invention comprises an improved volute spring; and its object is to provide a spring which works easily at the beginning of the stroke, but whose resistance increases rapidly and uniformly during the remainder of the stroke, as well as to provide a spring of high capacity by making use of the strength of the metal in both directions—that is, both axially and radially of the spring.

The invention consists, generally stated, in forming the spring of a bar of metal of other than round cross-section, preferably of a flat rectangular bar, which is coiled at an angle, so that after an initial ordinary spring movement the different turns contact and produce friction, which augments the original capacity of the spring. This frictional movement is governed by making the different turns of different contours, so that at the beginning of the frictional engagement adjacent turns contact at two points only, preferably lying opposite each other, while the other parts of the turns are free to yield laterally and allow the vertical movement to proceed until all turns touch practically all around, at which point the spring becomes solid.

In the accompanying drawings, Figure 1 is a plan view of my improved spring. Fig. 2 is a transverse section thereof on the line 2 2, Fig. 1, showing the spring fully expanded. Fig. 3 is a similar view showing the spring under severe compression; and Fig. 4 is a section on the line 4 4, Fig. 1.

My improved spring is of the usual volute form, having the several turns 1 2 3, &c., gradually increasing in diameter and in succession one slightly higher than the other, so as to form a spring of the usual volute type. The spring is formed from a bar other than round in cross-section, preferably from a rectangular bar or band having broad side faces, so as to give broad bearing-surfaces to reduce wear and greatly increase friction, as hereinafter described. This band is slightly inclined with reference to the axis of the coil, so that when the spring is compressed the faces of the turns come into frictional contact. A certain amount of frictional resistance could be obtained by having the faces of the several coils parallel and passing into each other. Such a spring would, however, be hard to make, and the friction, small as it would be, would act from the beginning of the stroke. To increase this friction, the coils are set in an angle to the axis of the spring, as shown. By varying this angle the amount of friction can be regulated.

To regulate the frictional movement, the several turns are made of different contours or curvatures, such as making alternate coils (when viewed in plan) circular and the other turns elliptic. As shown in the drawings, the turns 1 and 3 are elliptic, with their long axes at right angles to each other, while the intermediate turn 2 is circular. Consequently the several coils at first contact with each other only at two points (indicated at 7) on diametrically opposite sides. The result is that the stresses tending to force the coils together axially cause the several coils to bear one on the other, making it necessary to move the metal at the points 7 outwardly or radially, thus flattening the several turns and utilizing the bending strength of the metal to produce motion under friction, which reinforces the original capacity of the spring depending on the torsional strength of the material. This is of importance for the reason that the maximum stresses on the metal in the direction of the axis of the coil produces only torsional strains in the fibers and does not affect the strains which are brought about by bending the metal—that is, stresses applied radially of the coil.

The several turns may, if desired, be thickened at the points where they contact, as at the point 7, so as to compensate for wear at these points of contact, although this generally is not necessary, for the reason that the turns have very broad bearing-surfaces which of themselves greatly reduce wear.

The spring described utilizes the strength of the metal in both directions—that is, both against torsion and bending—and therefore the maximum strength is availed of to resist loads on the spring. The spring has an easy movement during the first part of its compression; but as soon as the several turns contact the strength is increased rapidly, but uniformly, by the frictional contact of the broad flat surfaces of the turns produced by bringing into action the resistance against bending stresses. As a consequence the

spring is admirably adapted for such uses where a small initial application occurs frequently and heavy loads or shocks occur less often. Preferably the spring is so constructed that the coils do not lock until the movement is limited by the width of the bands themselves, so that the solid height thereof is the same as the width of the band from which made. This is desirable, as it forms an absolute stop and prevents overstraining of the metal.

The spring described is of a very high capacity, and this is obtained by a single coil. Heretofore high-capacity springs have been obtained mostly by using extra coils. This is objectionable, as it necessitates additional material, the extra coils provide only a very small bearing-surface, and, furthermore, it is difficult to make the several coils fit closely in each other, and the slightest change in either or both coils due to manufacture or wear changes the frictional results and actually defeats the object of the second coil. A plurality of such coils is also objectionable, as it is practically impossible to get steel for the different coils of uniform strength or temper, due to the fact that in different batches of steel the mixture is never the same, and the heat necessary to bend the same may also be different, especially as the two coils are made at different times and under different heats. All of these difficulties are overcome by the single coil shown and described.

What I claim is—

1. A volute spring comprising a single coil formed of metal of other than round cross-section to provide broad contact-faces, alternate ones of the turns of said coil being elliptic and the remainder being circular.

2. A volute spring comprising a single coil formed of metal other than round cross-section and having the turns provided with broad contacting faces at an angle to the axis of the coil, alternate ones of the turns of said coil being elliptic and the remainder being circular.

3. A volute spring comprising a single coil formed of metal rectangular in cross-section and having the broad faces set at an angle to the axis of the coil, and arranged to contact under compression, alternate ones of the turns being elliptic and the remainder being circular.

4. A volute spring comprising a single coil formed of metal other than round cross-section to provide broad contacting faces at an angle to the axis of the coil, adjacent turns being of different curvatures and arranged to contact at points only, the metal of said turns being thickened at points of contact.

5. A volute spring comprising a single coil formed of metal other than round cross-section and provided with broad contacting faces at an angle to the axis of the coil, alternate ones of the turns of the coil being elliptic and the remainder being circular, and the metal of said turns being thickened at the points of contact.

In testimony whereof I, the said ARNOLD STUCKI, have hereunto set my hand.

ARNOLD STUCKI.

Witnesses:

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J. R. KELLER.