

July 19, 1932.

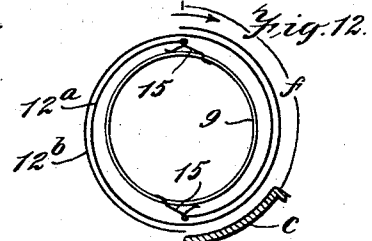
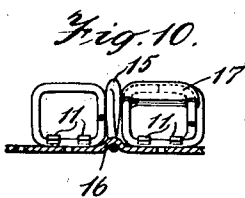
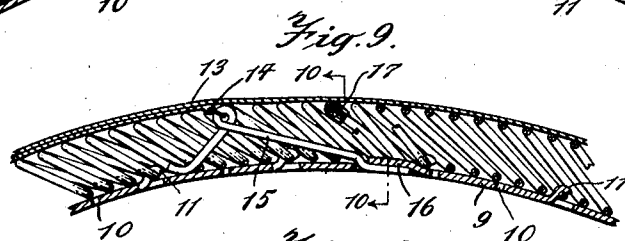
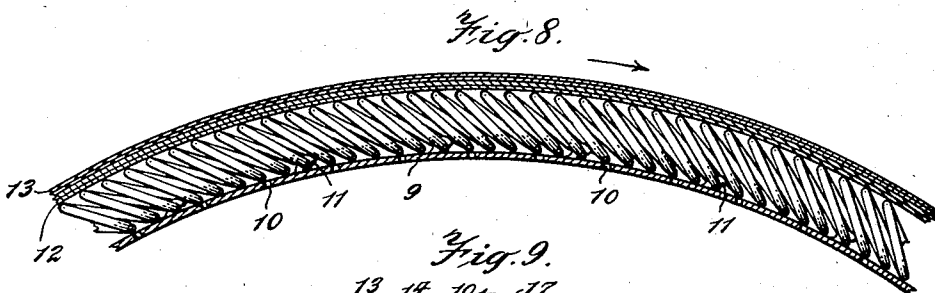
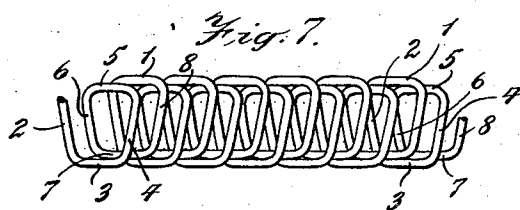
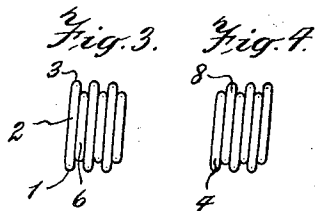
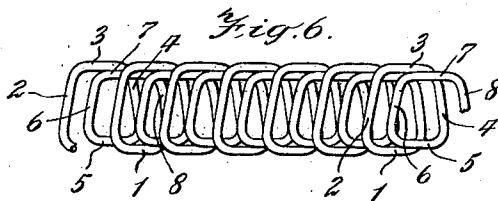
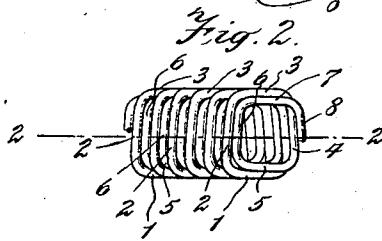
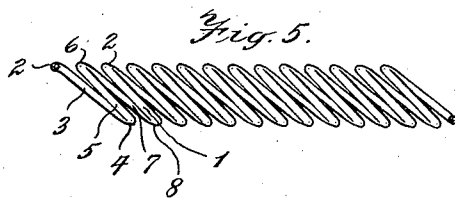
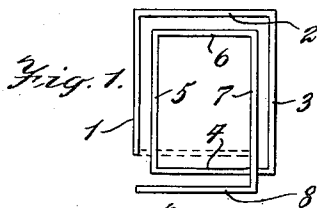
A. H. ADAMS

1,867,723

CONVOLUTED SPRING

Filed Oct. 20, 1928

2 Sheets-Sheet 1



ARTHUR H. ADAMS, INVENTOR

BY *Parsons*
HIS ATTORNEY

July 19, 1932.

A. H. ADAMS

1,867,723

CONVOLUTED SPRING

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2 Sheets-Sheet 2

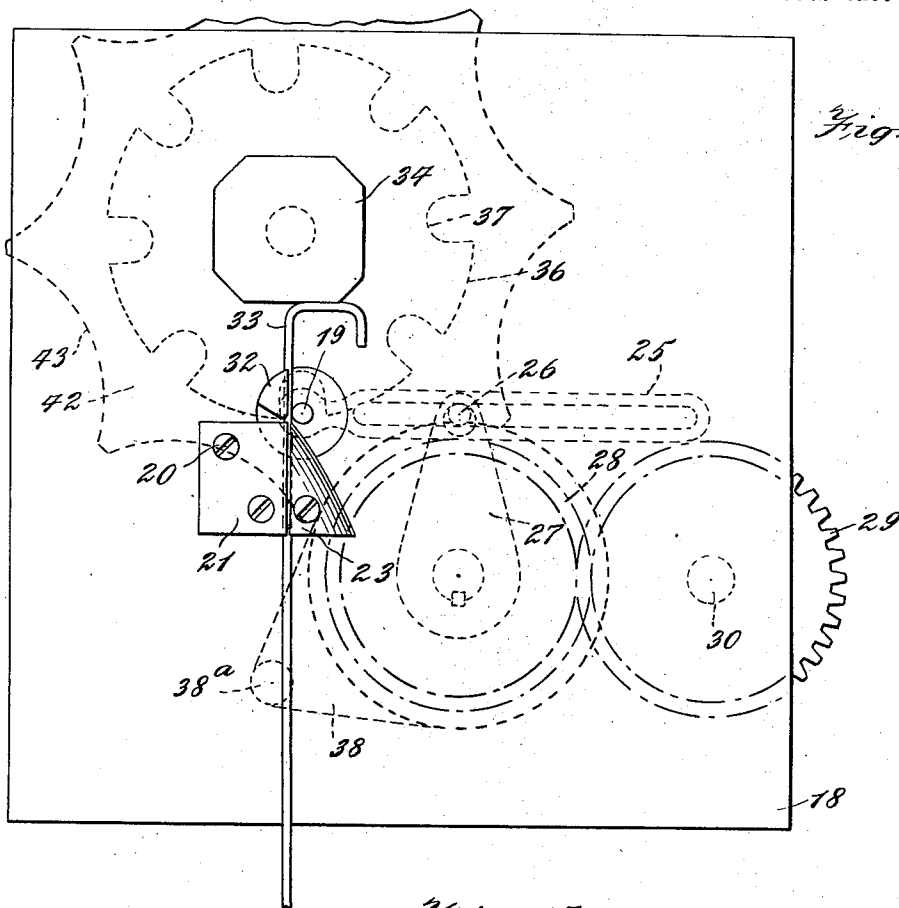


Fig. 13.

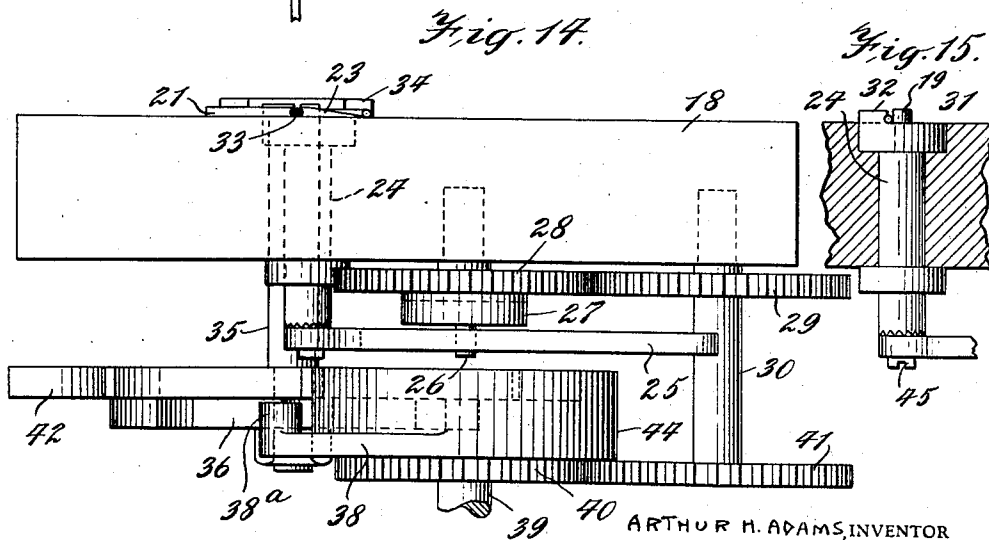


Fig. 14.

Fig. 15.

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UNITED STATES PATENT OFFICE

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CONVOLUTED SPRING

Application filed October 20, 1928. Serial No. 313,858.

This invention relates to springs and also to methods and apparatus for winding convoluted springs. More particularly, the invention is concerned with springs of the type
5 having inclined convolutions.

The invention is in the nature of an improvement upon the copending applications of Arthur H. Adams, Serial No. 284,722 and Serial No. 245,180 and has for one of its ob-
10 jects to produce a closely wound skewed spring which has a maximum of resiliency in a direction perpendicular to the axis of the spring convolutions.

As described in said applications, the char-
15 acteristics of skewed springs render them particularly advantageous in providing a resilient surface which is capable of localized compression without permanent deformation, such surfaces, for example, being em-
20 ployed in laundry machines, paper machines and the like. Accordingly, another object of the invention is to produce a resilient padding of the type disclosed in application
25 Serial No. 245,180, in which the resilient element consists of a skewed convoluted spring which has a maximum of transverse resiliency for a given size of spring convolution.

A feature of the invention resides in the
30 method of forming a skewed convoluted spring with the alternate convolutions of different sizes. As a result of this manner of forming the spring, the convolutions may be situated very close together without cor-
35 respondingly curtailing the local compressibility of the spring convolutions in a direction transverse to the common axis.

A further feature is to provide a resiliently
40 padded roll or the like employing as a resilient element thereof skewed springs having square or rectangular shaped convolutions.

Another feature pertains to the means for
45 uniting the free ends of a coiled spring which is wrapped around a roll or other equivalent surface.

As is well known, laundry rolls, etc. are
50 provided with one or more outer coverings of woven fabric with one end fastened to the roll and the other end free. In the case of rolls having a resilient padding formed of

coiled springs wrapped around the roll such as disclosed in application Serial No. 245,180, it is important that the covering be fastened so that during the rotation the winding effect on the covering will not produce ridges
55 in the spring padding. Accordingly, a still further feature pertains to the novel method and means for anchoring the roll covering or coverings whereby the tautness and the continuous winding effects thereof do not cause
60 any appreciable unevenness in the surface of the spring padding proper. Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed description and the ap-
65 pended claims.

For the purpose of illustrating one preferred manner of using a spring according to the invention the same will be disclosed as applied to a laundry ironing roll, but it will
70 be understood that this is merely for the purpose of illustration and that its applicability for analogous uses in other fields is within the scope of the invention.

Referring to the drawings, Fig. 1 shows in
75 schematic form the successive steps to be followed in winding a square or rectangular convoluted and nested spring according to the invention.

Fig. 2 is a top plan view of the spring as
80 it is formed according to the method illustrated in Fig. 1.

Fig. 3 is a top view of the spring, looking in the direction of the planes of the convolutions, and showing the alternate short and
85 long loop structure of the top surface of a spring of this construction.

Fig. 4 is a bottom plan view of the spring, looking in the direction of the planes of the convolutions, and showing the staggered
90 equal loop structure of the bottom surface of a spring of this construction.

Fig. 5 is a side elevation of a portion of a spring, according to the invention, with the convolutions spaced or stretched apart.
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Fig. 6 is a top plan view of the spring of Fig. 5.

Fig. 7 is a bottom plan view of the spring of Fig. 5.

Fig. 8 is a view showing a portion of a
100

laundry roll equipped with layers of fabric coverings which are spaced apart from the roll proper by a spring according to Figs. 5, 6 and 7. This figure also illustrates one preferred manner of locking the spring against creeping over the roll surface.

Fig. 9 illustrates a preferred manner of securing the end of a fabric covering to the roll.

Fig. 10 is an end view of the cover anchoring means of Fig. 9 and also shows the manner of uniting the free ends of one of the spring members by caps.

Fig. 11 is a sectional view of the spring capping means shown in Fig. 10 showing the "pinched-in" character of the cap.

Fig. 12 is a simplified diagram showing the method of attaching a plurality of separate layers of fabric coverings at diametrically opposite points using the anchoring means of Fig. 9.

Fig. 13 is a plan view of a machine for forming a spring such as illustrated in Figs. 2 to 7.

Fig. 14 is a view in elevation of the machine shown in Fig. 13.

Fig. 15 is a detail view of the wire bending means shown in Figs. 13 and 14.

Referring particularly to Fig. 1, there is diagrammatically shown a method of forming an inclined square or rectangular spring with successive convolutions of different sizes so that each small convolution may nest within the adjacent large convolutions. The nesting effect enables the convolutions to be closer together than has heretofore been found possible and without curtailing the resiliency when the convolutions are subjected to pressure in a direction transverse to their common axis. This feature is important when such a spring acts as a resilient supporting surface such as is used in laundry rolls or the like since it provides a non-absorbent resilient support for the fabric covering and also presents a substantially continuous support therefor. As shown in Fig. 1, a length of spring wire of the requisite cross section and preferably of non-corrosive material such as phosphor-bronze, or the like is subdivided into eight smaller lengths and each length is bent substantially at right angles with respect to the preceding length. In the case of a square spring the lengths 1, 2 and 5 are equal, while lengths 4 and 8 are shorter, preferably an amount corresponding to the thickness of the spring wire. Lengths 1, 2, 3 and 4 are then bent so that they normally lie at right angles with each other, thus forming a rectangular convolution and the purpose of making the length 1 shorter than length 3 is to give the convolutions of the completed spring an inclination, as described in application Serial No. 284,722. The succeeding convolution comprises the lengths 5, 6, 7 and 8. As will be seen, length 6 is shorter

than the corresponding length 2 of the larger convolution, so that the convolution 5, 6, 7, 8 may, when the spring is in use, enter or nest within the convolution 1, 2, 3, 4. The length 7, it will be understood, is the same as the corresponding length 3 of the large convolution. However, during the transverse compression of the spring the length 7 is inclined sufficiently to enable length 6 to fit below the corresponding length 2 of the convolution 1, 2, 3, 4. The foregoing described cycle of bending at predetermined lengths is repeated throughout the rest of the spring wire, resulting in a structure, as shown in Fig. 2, in which the successive convolutions are adjacent to each other but are progressively displaced along a common axis represented by the dot dash line 2—2. Fig. 2 represents a top plan view of the spring as it is formed. Fig. 3 is a top view of the spring looking in the direction of the plane of the convolutions and showing the alternate short and long loop structure of the top surface. Fig. 4 is a bottom plan view of the spring looking in the direction of the plane of the convolutions showing the staggered equal loop structure of the bottom surface. In order to use the spring shown in Figs. 2, 3 and 4 as a resilient supporting element, such, for example, as employed in laundry rolls, the spring is stretched until the turns thereof assume the desired spacing, for example, as shown in Figs. 5, 6 and 7. When the spring of Fig. 2 is thus stretched, in side elevation, all the convolutions appear to be of the same height, as shown in Fig. 5. However, when such a spring is locally compressed in the direction of the arrow the small convolutions are distorted and the upper ends fit within the left-hand adjacent large convolutions. This action will be clearer when considered in connection with Fig. 6, which shows a top plan view of the spring of Fig. 5. As shown in this figure, the length 6 of each small convolution is such that when the spring is compressed it will freely enter below the corresponding length 2 of the left-hand adjacent large convolution. Fig. 7 illustrates the relation between the bottom lengths of successive large and small convolutions. From a consideration of Figs. 5, 6 and 7, it will be seen that in the normal position of the spring the height of all the convolutions is substantially the same and in this respect the spring is similar to the inclined spring shown in application Serial No. 284,722. It is to be noted, however, that the transverse resiliency of the spring in this latter application is limited by the fact that during transverse compression each convolution piles up on the preceding convolution. With the spring shown in Figs. 5, 6 and 7 on the other hand, the degree of transverse resiliency is greatly increased since during compression the upper ends of the smaller convolutions enter the larger

convolutions and therefore do not exhibit the undesired piling up effect of the former spring. In effect, therefore, a spring such as shown in Figs. 5, 6 and 7 possesses substantially the same transverse resiliency as the spring of application Serial No. 284,722 but has twice the number of convolutions per unit length, thus providing a more nearly continuous upper supporting surface.

Referring to Fig. 8, the spring of Figs. 5, 6 and 7 is shown as applied to a roll periphery such as used in laundry machines. The roll proper comprises a base plate 9 which is profusely perforated, as represented by the numerals 10 to provide a free passage for steam and water vapor to the interior of the roll. The direction of rotation of the roll is represented by the arrow and it will be noted that the inclined spring is mounted on the roll so that the convolutions slant in a direction opposite to that of the rolls' rotation. In this respect the roll of Fig. 8 is similar to that disclosed in application Serial No. 245,180 referred to hereinabove. However, in the present embodiment, it is preferred to compose the resilient surface of a plurality of separate springs wrapped around the exterior of the base 9 instead of providing a single helically wrapped spring. In addition, in order to prevent creep of the springs over the base 9 as the roll is rotated, tabs 11 are suitably struck up from said base to provide slightly hooked prongs for engaging the lower lengths of the spring convolutions. The number of these tabs may be determined in accordance with the size of the spring and the maximum working pressure to be exerted on the roll.

As shown in Fig. 8, the spring supports a series of fabric coverings comprising an inner covering of duck or canvas 12 which is given substantially two complete turns around the springs' periphery, and overlapping the last half turn of the canvas is a layer of wool material 13. On top of this latter layer is the usual outer layer of muslin. If the duck covering 12 is fastened to the outer surface of the spring padding or if it is fastened to the roll 9 by tapes, strips or the like, as the duck is wrapped tighter and tighter by revolving against the heated ironing chest, a portion of the padding in the neighborhood of the fastening means will be locally compressed. This local compression will appear as a longitudinal depression in the surface of the roll and will mark the goods being ironed. For the purpose of properly anchoring the fabric covering to the roll so that the inward radial component of the pull resulting from the continual winding effect may not be transmitted to the springs, the inner end of the canvas covering 13, is fastened as shown in Fig. 9, by means of eyelets 14 which are coupled to corresponding eyelets formed in looped spring members 15.

As shown clearly in Figs. 9 and 10, the forward end of each member 15 is offset and registers with a corresponding narrow embossed or raised portion 16 in the surface of base 9, while the backward end of the member 15 is slightly curved and rests upon the outer surface of the base 9. Thus the fabric coverings may be held against the spring covering without the use of permanent fastenings to either the springs or the base plate since the members 15 are readily placed in position without the use of bolts or other fastening means. With this manner of fastening, as the roll rotates, there is a tendency to increase the tightness of the fabric coverings. However, since the covering is in effect resiliently attached to the base 9 the compression due to this winding effect is not transmitted to the springs, as would be the case if the fabric coverings were attached directly thereto.

Any manner of uniting the free ends of the spring padding may be employed. However, it is preferred to employ a cap union such as illustrated in Fig. 10 wherein opposite ends of each spring on being wrapped around the roll are rigidly clamped together by means of a metal cap 17, which has its edges pinched together as shown in Fig. 11.

Referring to Fig. 12 there is shown a novel method of attaching a series of fabric coverings whereby the winding effect on the coverings is relieved during substantially one-half of each revolution of the roll. As shown in Fig. 12 the roll 9 is provided with duck or canvas covering for the spring padding which is preferably the same type of padding as disclosed in Figs. 8 and 9. For the purpose of simplifying the drawings, however, the spring padding is omitted from Fig. 12. Instead of providing a single length of duck covering which is given two turns around the roll as described in connection with Fig. 8, the duck covering is divided into two lengths 12^a and 12^b each of which goes around the roll once, and fastened at diametrically opposite points to the roll by means of elements 15 as described hereinabove. A heated ironing chest C is shown in cooperative relation with a portion of the roll surface. By means of the two part covering as shown in Fig. 12, the greater portion of the spring padding, which at any given instant is out of registry with the steam chest, is allowed to expand. For example, assume that the roll is rotating in the direction of the arrow, the spring padding in the arc *f* is free to expand and the wrapper 12^b can slacken over the wrapper 12^a in the rest of its periphery. The wrapper 12^a is, of course, being held tight from the point where it is fastened to member 15 to the far edge of the chest C. However, when the free end of wrapper 12^a leaves the chest, the said wrapper can slacken and also the last quarter turn of wrapper 12^b. Thus the

progressive and increasing tightening which occurs when a single length of duck is employed, is avoided.

Referring to Figs. 13, 14 and 15, there will now be described a machine for forming the spring shown in Figs. 2, 3 and 4. This machine comprises generally a fixed platform or table 18 which has centrally located therein a forming pin 19. Fastened to the upper surface of the table 18 by screws 20 is a relatively thin plate 21 which has its right-hand edge grooved, as clearly shown in Fig. 14. Cooperating with the grooved edge of plate 21 is another thin plate 23 which has a slanting upper surface, as shown in Fig. 13 and has its left-hand edge grooved to register with the grooved edge of the plate 21 to provide a guide for the spring wire 33. The standard 24 which carries the forming pin 19 is mounted for rotation in the table 18 and has adjustably fastened thereto at its lower end a slotted arm 25. The slotted arm 25 cooperates with a pin 26 carried by member 27 which is adapted to be rotated through suitable gears 28 and 29 from the driving shaft 30. As shown more clearly in Fig. 15, the upper end 31 of the standard 24 has most of its surface cut away with the exception of a segment indicated by the numeral 32. This segment in the normal position of the standard has one edge grooved and in alignment with the corresponding grooved edge of the plate 21. It is clear therefore that when the standard 24 is rotated by means of the pin slot arrangement the wire 33 is bent around the pin 19. The pin slot arrangement is so designed that the wire is carried around the pin to such a point that it is given a normal set of substantially 90°. For the purpose of controlling the points at which the wire is to be bent by the member 32, there is provided a movable stop 34 in the form of a polygonal faced member mounted on a shaft 35 which carries at its lower end a member 36 provided with eight slots 37. The shaft 35 and the stop 34 are adapted to be rotated in a step by step manner by means of an arm 38 which is fastened to a shaft 39 driven from the main shaft 30 through suitable gears 40 and 41. Arm 38 carries a projection 38^a which is adapted to engage the slots 37 to advance the member 34 one step in the direction of the arrow, for each revolution of shaft 39. For the purpose of preventing overthrow and positively holding the stop 34 between steps a Geneva like member 42 is fastened to shaft 35 above the member 36 and out of the path of the rotating projection 38^a. Member 42 is provided with cut-out portions 43 which register with a corresponding circular member 44 carried by the shaft 39, said circular member being preferably formed integral with the rotating arm 38. If desired, any other well known form of Geneva movement and stop

may be employed and the shaft 35 may be rotated and held by stepping and holding pawls as will be apparent. The stop member 34 is so designed that the respective faces thereof are displaced from the center of the shaft 35, distances corresponding to the lengths at which the wire is to be bent. Any suitable means may be provided for feeding the wire against the stop faces and the relation between the operation of the pin slot 25, 26 and the members 36 and 38 is such that the wire is first moved forwardly against the stop and then the arm 25 is rotated carrying with it the projection 32 and wire 33 which is thereupon bent around the pin 19. As soon as the wire is thus bent, it is prevented from being fed forward against the stop by member 32 until this member is again restored to the position shown in Fig. 11, i. e. in line with the edge of member 21. When the pin 26 has been advanced to its maximum throw, which is determined by the degree of bend necessary to be given to the wire to enable it to assume a normal 90° bend, the direction of rotation of the arm 25 is reversed and the member 32 is again brought into alignment with the edge of plate 21. This, of course, permits the wire to feed forward to stop 34. During this return movement of the member 32, the stop 34 is advanced one step to bring another face thereof in registry with the wire and the wire moves against this new face. The above operation is cyclically repeated, resulting in a spring such as shown in Figs. 2, 3 and 4. Inasmuch as different kinds of wire will require different adjustments of the machine to give the requisite "overbend" the bending segment 32 may be adjusted angularly with respect to the center of pin 19 by loosening the screw 45 and turning the standard 24 clockwise or counterclockwise, in accordance with the characteristics of the wire to be bent. In order to equalizer for the different adjustments of member 32 and to cause said member to be returned to its originally adjusted position for each revolution of member 38, the pin 26 may be adjustably mounted on arm 27.

What I claim is:

1. As a new article of manufacture a convoluted spring having the convolutions inclined to the spring axis, and with portions of adjacent convolutions nesting when subjected to pressure transverse to their common axis.

2. As a new article of manufacture a convoluted spring having the convolutions inclined to the spring axis and with corresponding sides of adjacent convolutions of unequal lengths.

3. As a new article of manufacture a convoluted spring having the convolutions inclined to the spring axis, adjacent convolutions being asymmetric for increasing the number of convolutions per unit length of

spring without substantially curtailing the transverse resiliency thereof.

4. A multi-sided convoluted spring having the convolutions thereof inclined to the spring axis, and having adjacent convolutions of unequal sizes whereby a portion of one convolution may fit within a corresponding portion of an adjacent convolution when the spring is subjected to transverse pressure.

5. The method of increasing the transverse resiliency of a spring with inclined convolutions which comprises making adjacent convolutions of unequal sizes so that one convolution may enter a preceding convolution when the spring is subjected to transverse pressure.

6. An inclined convoluted spring in which all the convolutions have substantially the same height but with alternate convolutions of unequal widths whereby a portion of one convolution may nest within the corresponding portion of an adjacent convolution.

7. A spring having multi-sided inclined convolutions with the upper edges of all convolutions lying substantially in the same plane when the spring is normal, and with the upper edges of alternate convolutions displaced when the spring is subjected to transverse pressure.

8. The method of winding an inclined convoluted spring which comprises dividing a spring wire into equal unit lengths, subdividing each unit length into eight shorter lengths with the second and sixth lengths unequal and bending each sub-unit length at substantially right angles to the preceding sub-unit length.

9. The method of forming an inclined convoluted spring which comprises selecting unit lengths of wire, subdividing each unit length into eight smaller lengths with at least three of said smaller lengths of unequal size, and bending each smaller length at substantially right angles to the preceding small length.

10. In a resilient pad for a laundry machine, a base plate, and a resilient padding mounted thereon, said padding comprising a convoluted skewed spring in which adjacent convolutions differ from each other and alternate convolutions are alike.

11. In a resilient pad for a laundry machine, a base plate and a resilient padding secured thereto, said padding comprising a convoluted spring having the convolutions inclined to the spring axis and with corresponding convolutions of unequal lengths.

12. In a resilient pad for a laundry machine, a base plate and a resilient padding mounted thereon, said padding comprising a multi-sided convoluted spring having the convolutions thereof inclined to the spring axis and having adjacent convolutions of unequal sizes whereby a portion of one convolution may fit within a corresponding portion of an

adjacent convolution when the spring is subjected to transverse pressure.

13. In a resilient pad for a laundry machine, a base plate, a resilient padding mounted thereon, said padding comprising a plurality of convoluted springs positioned around said plate; and means for uniting the respective ends of said springs, said means comprising a hollow cap member fitted over corresponding portions of said respective ends to enclose top and side portions of said ends.

In testimony whereof, I have signed my name to this specification, October, 1928.

ARTHUR H. ADAMS.

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