

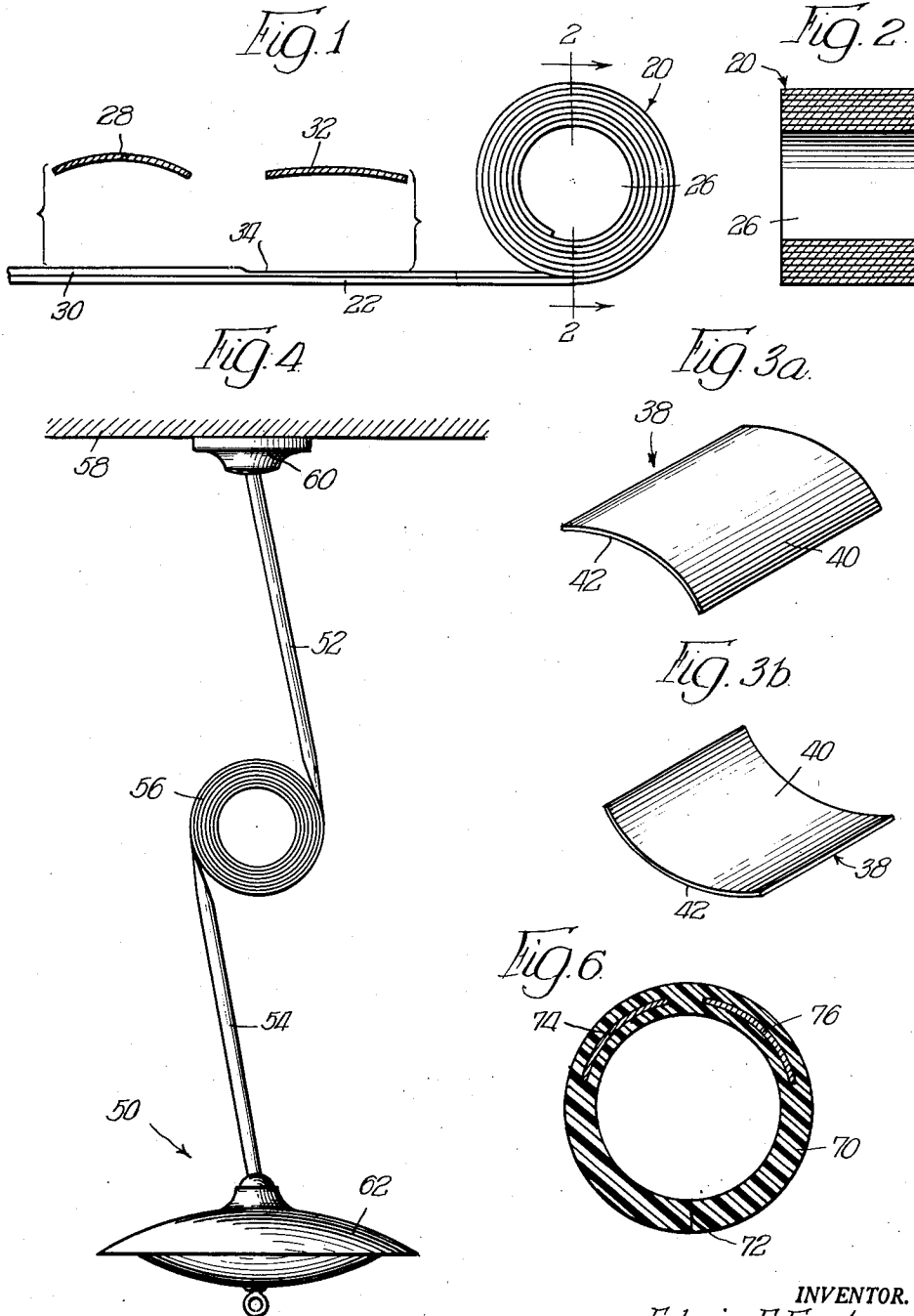
July 3, 1962

E. E. FOSTER
SPRING

3,042,742

Filed Oct. 17, 1960

4 Sheets-Sheet 1



INVENTOR.
Edwin E. Foster,
BY
Byron, Hume, Green & Clement.
attys.

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E. E. FOSTER

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Fig. 5

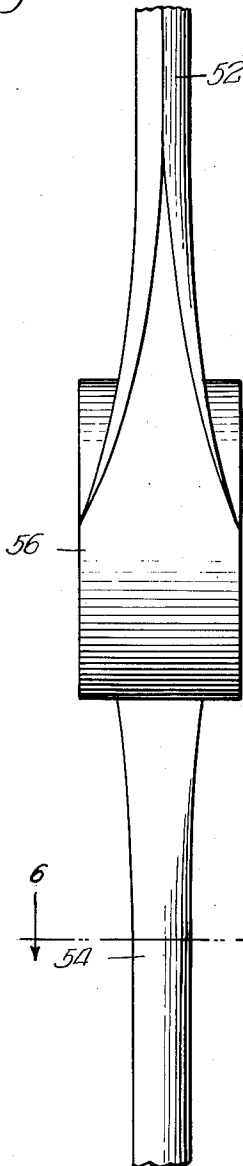


Fig. 7

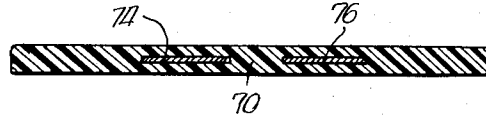


Fig. 8



Fig. 9

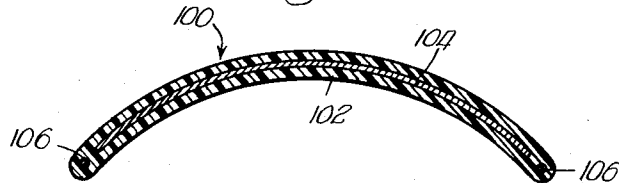


Fig. 10

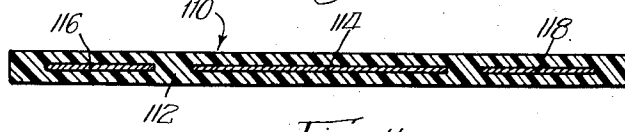
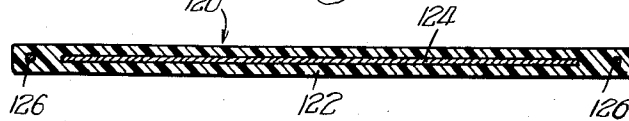


Fig. 11



INVENTOR.

Edwin E. Foster,

BY

Byron, Hunt, Brown & Clement
Attys

July 3, 1962

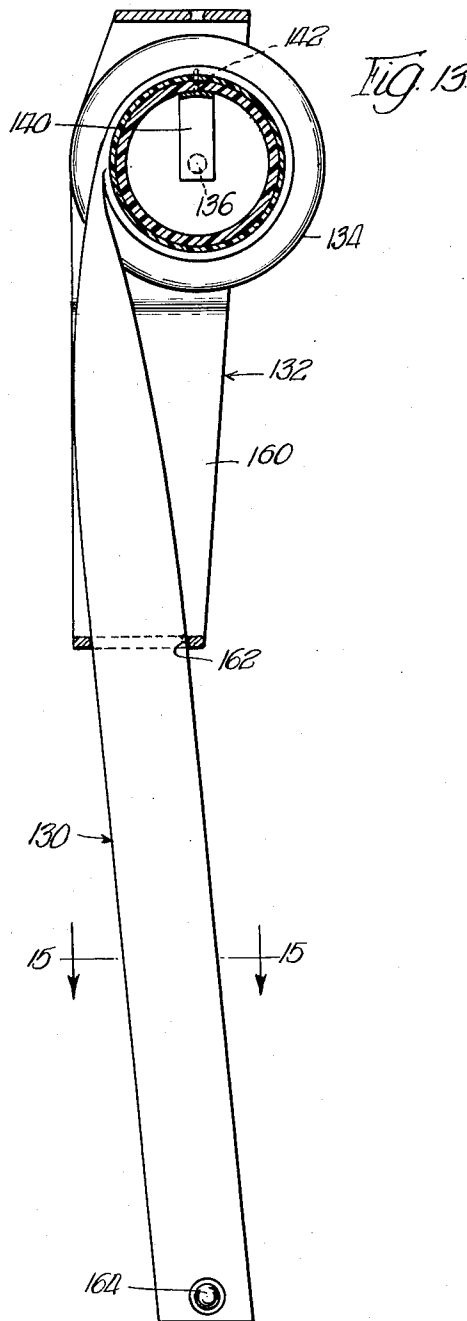
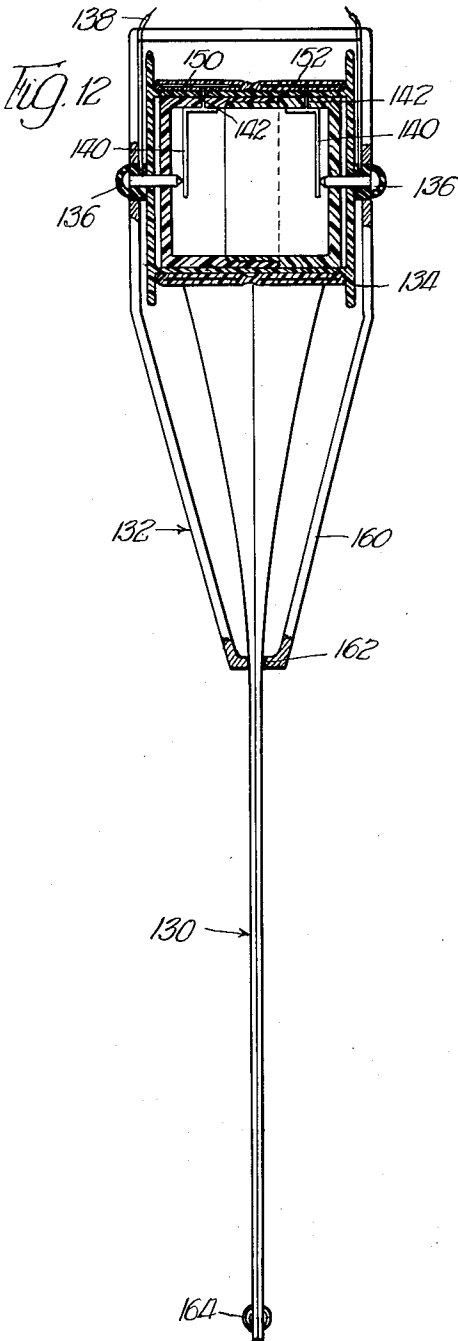
E. E. FOSTER

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INVENTOR.

Edwin E. Foster,

BY

Byron, Hume, Groen & Clement.

attys

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SPRING

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Fig. 14

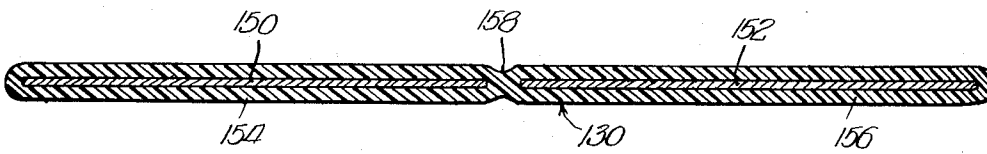


Fig. 15

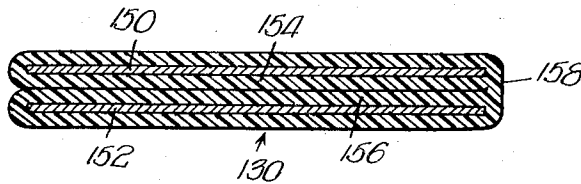
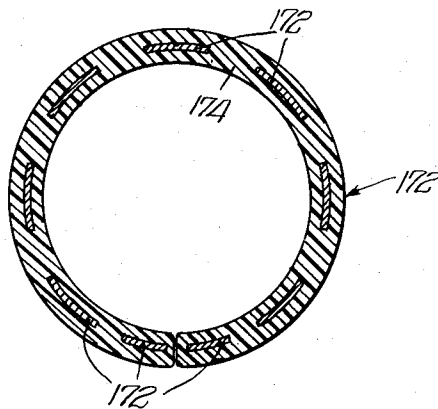


Fig. 16



INVENTOR.

Edwin E. Foster,

BY

Byron, Hume, Gorn + Clement
attys.

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3,042,742
SPRING

Edwin E. Foster, 1805 Camp Craft Road, Austin, Tex.
Filed Oct. 17, 1960, Ser. No. 62,946
10 Claims. (Cl. 174-69)

This invention pertains to a spiral spring and in particular to a new and useful improvement in spiral springs and is a continuation in part of application Serial No. 775,490, filed November 21, 1958, now having been issued on October 18, 1960, bearing Number 2,956,795.

In the aforementioned Letters Patent there is disclosed has been longitudinally stressed to assume a plurality of tightly wound convolutions when the coil is in its reposed condition. The ribbon is further formed to tend to assume a concave-convex cross section in which the curvature may be away from or toward the center of the coil. By combining the proper amounts of cross curvature and longitudinal stress it is possible to obtain a coil spring having characteristics not found in springs known heretofore. For example, it is possible to impart stability to the spring so that it may be extended from its coiled condition and left unrestrained without becoming entangled in attempting to return to the coiled condition. By varying the relationship of the cross curvature and longitudinal stress it is possible to make the ribbon self-winding, self-extending, or in balance and still have sufficient stability to avoid the problem of entanglement present with the extendable prior art springs, such as those shown in 2,609,191, 2,609,192 and 2,609,193. As a result of these unique characteristics it is possible to use the spring in various ways not heretofore possible.

I have now further discovered that a spring may be constructed in accordance with the principles set forth in the aforementioned application in which the ribbon is composed in part of a metallic portion and of a non-metallic portion. The metallic portion, by way of example, may be constructed of some conventional spring material, such as spring steel or brass. The non-metallic portion may be constructed of various types of plastic materials, such as neoprene, polyamide materials such as nylon, polyethylene and the like. As will be seen hereinafter such a spring permits numerous uses not possible heretofore.

These and other features of the invention will be apparent upon reading of the specification with reference to the following drawings:

In the drawings:

FIGURE 1 is a front elevational view of one type of coil spring shown in Letters Patent No. 2,956,795 and is representative of the springs constructed in accordance with the invention disclosed and claimed therein.

FIGURE 2 is a sectional view taken along the lines 2-2 in FIGURE 1.

FIGURE 3a is a perspective view of a segment of the spring shown in FIGURE 1 when in the extended condition.

FIGURE 3b is a perspective view of a segment shown in FIGURE 3a when in the coiled condition.

FIGURE 4 is a front view in elevation of a retractible lamp.

FIGURE 5 is a side view of the lamp in elevation.

FIGURE 6 is a sectional view taken along the lines 6-6 of FIGURE 5.

FIGURE 7 is a sectional view of a segment of the ribbon when in the coiled condition.

FIGURES 8, 9, 10, and 11 are sectional views of modifications of the spring ribbon when in their extended conditions.

FIGURES 12 and 13 illustrate another modification of the spring especially adapted for use in the construction of electrical appliances and fixtures.

FIGURE 14 is a sectional view of a segment of the

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spring ribbon utilized in the construction of the modifications shown in FIGURES 12 and 13 when in the coiled condition.

FIGURE 15 is a sectional view taken along the lines 15-15.

FIGURE 16 is a cross sectional view of another modification of the spring.

Referring now to FIGURES 1 and 2 there is shown a coil spring, generally denoted by the numeral 20, which embodies the invention disclosed and claimed in the aforementioned Letters Patent. The spring 20 is constructed of a ribbon 22 stressed substantially throughout its length to form a coil 26 composed of a plurality of tightly wound convolutions when in its reposed condition. A cross section 28 taken from an unstressed portion 30 shows that the ribbon prior to stressing had a cross sectional curvature in which the concave side was away from the center of the coil 26. A cross section 32 taken from an extended portion 34 of the stressed ribbon shows a resultant cross sectional curvature in which the concave side is away from the center of the coil. It will be noticed that the cross curvature shown in the cross section 32 is somewhat less than that shown in the cross section 28. This would appear to be the result of the opposing natures of the formed cross section and the natural cross section, as is more fully explained in the aforementioned letters patent.

Referring now to FIGURE 2, it can be seen that the ribbon 22 when in the coiled condition has a substantially flat cross section. In other words, the cross sectional curvature shown in the cross section 32 must be flattened out as the ribbon is allowed to rewind from the extended condition to the coiled condition.

It has been found that the strength of the spring shown in FIGURE 1 may be somewhat greater than, equal to, or considerably less than extendable springs of the same type which do not have the cross curvature. By strength it is meant the tendency of the spring to return from an extended condition to the coiled condition. The variation in strength stems from the fact that the curvature in the extended portion of the spring must be flattened crosswise when rewound and that the force required to flatten is in opposition to the longitudinal stress component tending to rewind the ribbon. If the force required to flatten is less than the longitudinal component, then the ribbon will be self-winding. On the other hand, if the force required to flatten is greater than the longitudinal component, then the ribbon will be self-extending. Finally, if the longitudinal component is equal to the force the spring will be in balance and be neither self-winding or self-extending.

It has also been discovered that this spring has a rather unique characteristic which permits various uses as was mentioned previously. This characteristic is the stability imparted to the stressed ribbon by the cross curvature. If the formed cross section, such as shown in FIGURE 7, is sufficient to form a resultant cross curvature the resultant will tend to eliminate the tendency for the extended stressed ribbon when unrestrained to become entangled. The stressed ribbon will readily wind upon the coil but will do it by means of rotating the coil so that the extending ribbon moves in a longitudinal direction toward the coil. The greater the amount of cross curvature the greater the stability.

It has been found that the spring shown in FIGURE 1 when fully extended so that there is no coiled portion will tend to remain in its extended condition even if unrestrained. This tendency to remain in the extended condition is at least partially dependent upon the magnitude of the resultant cross curvature relative to the longitudinal stress component. When such a spring is in the extended condition it may be recoiled by bending the ribbon in the

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direction of the coil so as to partially form a first convolution. If the spring is of the self-winding type then it will continue winding of its own accord until all of the stressed ribbon has been wound into a coil. If the spring is of the balanced or self-extending type, then it will be necessary to provide a slight longitudinal force to wind the ribbon into the coiled condition.

The spring in FIGURE 1 has the further characteristic that an extended length of stressed ribbon will act as a cantilever and will support a considerable amount of weight. The load that may be supported without buckling is dependent upon the magnitude of the resultant cross curvature. The extended portion will also support a load acting in a longitudinal action toward the coil without buckling. Again, the size of the load required to buckle the extended portion is dependent upon the magnitude of the cross curvature.

Referring now to FIGURES 3a and 3b, there is shown a rectangular segment, generally denoted by the numeral 38, of the spring shown in FIGURES 1 and 2. In FIGURE 3a the segment is shown in a condition equivalent to the ribbon when in the extended position. When in such condition, the segment has a cross sectional curvature which includes a convex side 40 and a concave side 42. In FIGURE 3b the segment 38 is shown in a condition equivalent to the coiled condition in which the segment is flat in the transverse direction but has a longitudinal curvature. When in the longitudinal curved condition the side 40 then becomes concave and the side 42 convex.

It has been found that the spring segment shown in FIGURES 3a and 3b will remain in whatever condition it is placed and will change to the other condition only under some positive force. As a result of this unique action the segment may be utilized in various ways not heretofore possible. For example, the segment may be utilized as an electrical switch for selectively connecting two spaced electrical leads. In that construction two diagonally opposed corners of the segment may be aligned with the leads and manually-operated push member aligned with the center of the segment for flexing it between the extended and coiled conditions. Assuming that the segment 38 is mounted so that when in the extended condition as shown in FIGURE 3a, the opposing corners are in contact with the electrical leads, the current will be transmitted through the spring. If it is desired to deenergize the circuit, the segment need merely to be flexed so that the spring assumes its equivalent coiled condition as shown in FIGURE 3b. When in that condition the opposing corners are flexed upwardly out of contact with the electrical leads. This construction is merely a schematic example of the many uses to which a segment such as shown in FIGURES 3a and 3b may be used.

One of the problems encountered in the manufacture of such springs is the formation of sufficient cross curvature to provide the desired result. For example, many times the longitudinal stressing of the ribbon will limit the amount of cross curvature so that it is not possible to achieve the full range of types of springs theoretically possible. I have discovered that by constructing the spring in the manner described hereinafter such problem is obviated.

By way of example the spring will be described as utilized in the construction of an extendable lamp. The lamp construction is similar to that shown in FIGURE 23 of the aforementioned Letters Patent 2,956,795, except for the novel construction of the spring as will be disclosed hereinafter. In essence, the lamp 50 is composed of a first spring ribbon 52 and a second spring ribbon 54. The ribbons have been interleaved so as to form a single coil 56. The free end of the ribbon 52 is connected to the supporting wall or ceiling 58 by means of a fixture 60 of some suitable construction. The free end of the ribbon 54 is secured to a lamp fixture 62 of

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some suitable type. The spring ribbons 52 and 54 are constructed so as to be self-winding with the self-winding force being essentially equal to the weight of the lamp 62. Thus, when the lamp is suspended freely at the end of the spring it will remain stationary. When the lamp is partially lifted the spring will then rewind or retract until the lifting force is removed. Conversely, if the lamp is to be lowered it is merely pulled downward to the desired height.

In FIGURE 6 there is shown a cross section of the spring ribbon embodying the invention as utilized in the construction of the retractable lamp. In the preferred embodiment the ribbon is composed of a plastic portion 70 and the self-coiling spring ribbons 74 and 76. As mentioned previously the plastic may be any one of those readily available such as nylon, neoprene, polyethylene, and the like. The self-coiling spring ribbons 74 and 76 are enclosed within the plastic portion 70 and may be of any suitable type. In this preferred embodiment the springs 74 and 76 are of the type that assume a plurality of tightly wound convolutions when in repose as was mentioned previously. The ribbons 74 and 76 are substantially flat in cross section and are described in detail in the aforementioned Letters Patent 2,609,191, 2,609,192 and 2,609,193. When the springs 74 and 76 return from their extended position to the coiled condition they must exert sufficient force to overcome the transverse curvature of the plastic portion 70. In other words, the curvature of the plastic portion 70 subtracts from their retracting force of the springs 74 and 76 as mentioned previously.

The magnitude of the cross component will be dependent upon the degree of curvature and the weight of the plastic stock; the greater the weight of the curvature, and the greater the thickness and weight of the stock, the greater the amount of force necessary to overcome the curvature. Thus, the spring constructed in this manner may be made self-winding, self-extending or in balance. As a result of this construction the problem of imparting sufficient cross curvature is eliminated. The plastic portion may be readily formed or molded into any amount of cross curvature necessary to give the result desired. One method for constructing the spring is to place the spring ribbons between two strips of plastic and then securing the two strips together. The strips may be pre-formed or formed during the securing operation to the desired cross curvature.

A still further problem in the specific lamp shown in FIGURES 4 and 5 is providing means for connecting the lamp to some source of electrical energy. Normally the practice is to provide a separate cord for transmitting the electrical energy. However, in view of the extendable nature of the lamp support, it is necessary to provide some means for permitting the lengthening and shortening of the cord. This latter requirement may be fulfilled by means of a reel or the like. Such a construction is normally quite costly and has limited the sales of retractable lamps of this type.

By imbedding the springs 74 and 76 within the plastic material 70, it is possible to utilize them for the transmission of the electrical energy to light the lamp 62. In this manner it is possible to eliminate the cord normally used in the construction of such lamps.

Referring now to FIGURES 8, 9, 10 and 11, there is shown modifications of the invention.

In FIGURE 8 the cross section of the spring is trough-shaped with the self-coiling spring ribbon being centrally disposed. In essence, the spring 80 shown in FIGURE 8 comprises a center portion 82 and two angularly depending sides 84 and 86. As mentioned previously, a self-coiling spring ribbon 88 of a substantially flat cross section of a suitable type is enclosed within the central portion 82. A pair of electrical conductors 90 and 92 are enclosed within the respective depending sides 84 and 86. The

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cross section shown in FIGURE 8 represents the spring when in the extended condition. When in the coiled condition the cross section will be substantially flat as described previously. Thus, sufficient forces must be exerted by the spring ribbon 88 or some auxiliary source to wind the spring 80 from the extending to the coiled condition. The size and angular pitch of the depending sides 84 and 86 will determine the amount of force expended in the coiling of the extended ribbon. By varying these factors with respect to the longitudinal strength of the spring ribbon 88, it is possible to make a self-winding, self-extending or balanced spring, as described previously.

The cross section of another modification is shown in FIGURE 9. In this instance the spring 100 comprises the plastic sheath 102 in which is enclosed a spring 104 substantially identical with that shown in FIGURES 1 and 2. At the ends of the spring 104 there are disposed the electrical conducting wires 106 which are completely insulated by the plastic material. Again, the degree of curvature will determine the characteristics of the spring.

In FIGURE 10 there is shown another modification 110 in which the cross section is substantially flat both when extended and coiled. The spring 110 comprises the plastic sheath 112 in which is enclosed the spring ribbon 114. Adjacent the marginal portions of the ribbon are the ribbon electrical conductors 116 and 118, which are spaced and insulated from the spring 114 by the plastic material comprising the sheath 112.

The modification shown in FIGURE 11 is generally denoted by the numeral 120 and is similar to that shown in FIGURE 10. The spring 120 is of a substantially flat cross section both in the extended and coiled conditions and comprise the plastic sheath 122 in which is imbedded the spring ribbon 124. At the sides of the spring ribbon 124 in a closely spaced relationship are the electrical conducting wires 126. The wires 126 are completely insulated both from the outside and the spring ribbon 124 by the plastic material comprising the sheath 122.

Referring now to FIGURES 12 and 13 there is shown another modification of the spring especially suited for use in the construction of electrical connectors. The spring 130 is mounted within the housing assembly 132, which is provided with the spool 134 which is rotatably mounted on the pins 136. The spring ribbon 130 is secured at one end to the spool 134 in some suitable fashion and is adapted to be coiled thereon.

If the spring ribbon is to conduct electrical energy as described previously with reference to other modifications disclosed herein, the housing 132 and spool 134 may be provided with means for connecting the ribbon to a source of electrical energy. A pair of leads 138, which is adapted to be connected to a source of electrical energy (not shown), is received within the housing 132 and is connected to the pins 136. The shank ends of the pins 136 are connected from an electrical conductive material of some suitable type. The heads of the pins 136 are insulated, so as to prevent energizing the housing 132 and otherwise prevent a safety hazard to those using the invention. The ends of the pins 136 are in touching relationship with the conducting fingers 140 which extend radially therefrom. The outer ends of the fingers 140 are secured to the spool 134 by means of the electrical connecting pins 142. The pins 142 are in contact with the conducting portions of the spring 130. In this manner the spool 134 is free to rotate about its axis, so as to permit the winding and unwinding of the coil spring and still permit the spring to remain energized.

Referring now to FIGURE 14 there is shown a segment of the spring when in the coiled condition. The spring 130 includes two metallic spring ribbons 150 and 152 of some suitable type. For example, one preferred type of coiled spring is that shown in the aforementioned Letters Patent 2,609,191, 2,609,192 and 2,609,193. Each of the spring ribbons 150 and 152 are enclosed within plastic sheaths 154 and 156 of some suitable, flexible, insulated

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material, such as nylon, neoprene and the like. The sheaths 154 and 156 are joined by the recessed portion 158 which permits them to be folded so as to be in juxtaposed relationship as shown in FIGURE 15 when in the uncoiled condition.

Referring back to FIGURES 12 and 13 it can be seen that the housing 132 includes the guide portion 160, which includes the slot 162 through which passes the spring ribbon 130. The slot 162 is elongated in shape and is of a width slightly larger than the folded thickness of the spring 130 as shown in FIGURE 15. The end of the spring ribbon is secured in the folded condition by means of the rivet 164 which further prevents the ribbon from completely retracting within the housing 132. When the spring is extended from the housing 132 the ribbon is unwound from the spool 134 and then is forced to bend at the connecting portion 158 by the slot 162.

It will be recalled that one of the disadvantages of the flat spiral springs utilized in the construction of the spring shown in FIGURE 14 is that it tends to become entangled when unrestrained. By bending the spring ribbon 130 about the bridging portion 158 the spring ribbons 150 and 152 are placed in opposing relationship. For example, if bent in one direction the spring ribbon 150 will tend to coil to the left as shown in FIGURE 12 and the ribbon 152 to the right. As a result of this opposing relationship it is possible to eliminate the tendency to become entangled.

It will be apparent that the housing assembly 132 may be utilized in conjunction with other types of springs. For example, the cross curved springs that have been discussed previously in this application may be mounted within the housing assembly.

Referring now to FIGURE 16 there is shown a cross curved spring 170 which includes the combination of some spring material and an insulating material, such as neoprene, nylon and the like. In cross section it can be seen that the spring 170 consists of a plurality of regularly spaced metallic spring ribbons 172, which are enclosed within a plastic sheath 174 of some suitable type. The plastic sheath 174 has been formed to assume a substantially tubular cross section when in the extended condition. When the spring 170 is retracted it will flatten as described previously in reference to the other modifications shown in this application.

Although certain embodiments have been shown and disclosed herein it is to be understood that they are merely by way of example and are in no manner to be construed as limitations. It is apparent that various modifications may be made without departing from the spirit of the invention.

It is claimed:

1. A coil spring comprising a ribbon permanently stressed into a plurality of tightly wound convolutions when in repose, each of said convolutions tightly engaging the preceding convolution when in repose, said ribbon having a tendency to assume a concave-convex cross section, said ribbon being composed of a flexible plastic ribbon and a metallic ribbon embedded within said plastic ribbon, said plastic ribbon having a formed transverse curvature.

2. A coil spring comprising a ribbon permanently stressed into a plurality of tightly wound convolutions when in repose so that each of said convolutions engages the preceding convolution, said ribbon formed to have a tendency to assume a concave-convex cross section, said ribbon being composed of a flexible plastic ribbon having said tendency to assume said concave-convex cross section and a metallic ribbon embedded within said flexible plastic ribbon and stressed into a plurality of tightly wound convolutions when in repose.

3. A coil spring comprising a ribbon permanently stressed into a plurality of tightly wound convolutions when in repose so that each of said convolutions tightly engages the preceding convolution, said ribbon formed

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to have a tendency to assume a concave-convex cross section with the convex side of said ribbon being adjacent the preceding inner convolution of the coil spring, said ribbon being composed of a plastic ribbon having said tendency to assume a concave-convex cross section and a metallic ribbon permanently stressed into a plurality of tightly wound convolutions when in repose.

4. A coil spring as defined in claim 3 which further includes electrical conductors enclosed within said plastic ribbon and insulated from said metallic ribbon.

5. A coil spring comprising a ribbon permanently longitudinally stressed into a plurality of contiguous convolutions when in repose, said stressed ribbon having a longitudinally stressed component when extended from its convoluted condition, said longitudinal stress component tendency to cause said stressed ribbon to return to its convoluted condition, said stressed ribbon also formed to have a tendency when extended to assume a concave-convex cross section in which the convex side is toward the center of the coil, said ribbon being forced to assume a substantially flat cross section when said extended portion is rewound into its coiled condition, the flattening of said concave-convex cross section forming a cross stress component in opposition to said tendency to return to said convoluted condition resulting from the longitudinal stress component, said stressed ribbon being composed of a plastic ribbon and a metallic ribbon enclosed therein.

6. A coil spring comprising a ribbon permanently longitudinally stressed into a plurality of contiguous convolutions when in repose, said stressed ribbon having a longitudinal stress component when extended from its convoluted condition, said longitudinal stress component tending to cause a natural concave-convex cross section in said stressed ribbon and further tending to cause said stressed ribbon to return to its convoluted condition, said stressed ribbon also formed to have a tendency when extended to assume a concave-convex cross section in which the convex side is toward the center of the coil, said ribbon being forced to assume a substantially flat cross sec-

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tion when said extended portion is wound into its coiled condition, the flattening of said concave-convex cross section forming a cross stress component in opposition to said tendency to return to said convoluted condition resulting from the longitudinal stress component, said cross stress component being dependent upon the magnitude of cross section curvature when said stress ribbon is in its extended condition, said stressed ribbon being composed of a plastic ribbon having said tendency to assume said concave-convex cross section and a metallic spring ribbon enclosed therein and being longitudinally stressed into a plurality of contiguous convolutions when in repose.

7. A coil spring as defined in claim 6 in which said cross stress component is substantially smaller than said longitudinal stress component, whereby said stressed ribbon when in the extended position is self-coiling.

8. A coil spring as defined in claim 6 in which said cross stress component is substantially equal to said longitudinal stress component, whereby said stressed ribbon when unrestrained will remain in the extended condition or the convoluted condition.

9. A coil spring as defined in claim 6 in which said cross stress component is substantially greater than said longitudinal stress component, whereby said stressed ribbon when in its convoluted condition is self-extending.

10. A coil spring comprising a ribbon composed of a flexible plastic ribbon and a metallic ribbon embedded within said flexible plastic ribbon, said plastic ribbon having a formed transverse curvature, said metallic ribbon being permanently stressed to assume a plurality of tightly wound convolutions when in repose.

References Cited in the file of this patent

UNITED STATES PATENTS

2,647,743	Cook	Aug. 4, 1953
2,932,503	Le Van	Apr. 12, 1960
2,956,795	Foster	Oct. 18, 1960

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,042,742

July 3, 1962

Edwin E. Foster

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 11, after "disclosed" insert -- and claimed a coil spring composed of a flat ribbon which --; column 4, line 34, for "weight" read -- degree --; column 5, line 21, strike out "In"; same line, strike out "there is shown another modification"; line 22, strike out "110 in which the cross section is substantially flat both" and insert instead -- illustrates the modification shown in FIGURE 8 but in coiled condition. Said modification is indicated at 110 but is the same as spring 80 in FIGURE 8 and the corresponding reference numeral in FIGURE 8 for each component will be set forth in parenthesis. Modification 110 is substantially flat --; line 23, strike out "extended and"; same line, after "110" insert -- (80) --; line 24, after "112" insert -- (82) --; line 25, after "114" insert -- (88) --; line 26, after "116" insert -- (92) --; same line, after "118" insert -- (90) --; line 27, after "114" insert -- (88) --; line 28, after "112" insert -- (82) --; line 29, strike out "The modification shown in"; same line, strike out "is generally"; line 30, strike out "denoted by the numeral 120 and is similar to that shown" and insert instead -- illustrates a sectional view of the modification shown in FIGURE 9, but in coiled condition. Said modification is indicated at 120 but is the same as spring 100 in FIGURE 9 and the corresponding reference numeral in FIGURE 9 for each component will be set forth in parenthesis. --; line 31, strike out "in FIGURE 10. The spring 120" and insert instead -- Said modification 120 --; line 32, strike out "both"; same line, strike out "extended and"; same line, for "conditions" read -- condition --; line 33, for "comprise" read -- comprises --; same line, after "122" insert -- (102) --; line 34, after "124" insert -- (104) --; line 35, after "124" insert -- (104) --; line 36, after "126", both occurrences, insert -- (106) --; line 37, after "124" insert -- (104) --; line 38, after "122" insert -- (102) --; line 55, for "connected" read -- formed --.

Signed and sealed this 15th day of October 1963.

(SEAL)
Attest:

ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS
Acting Commissioner of
Patents