

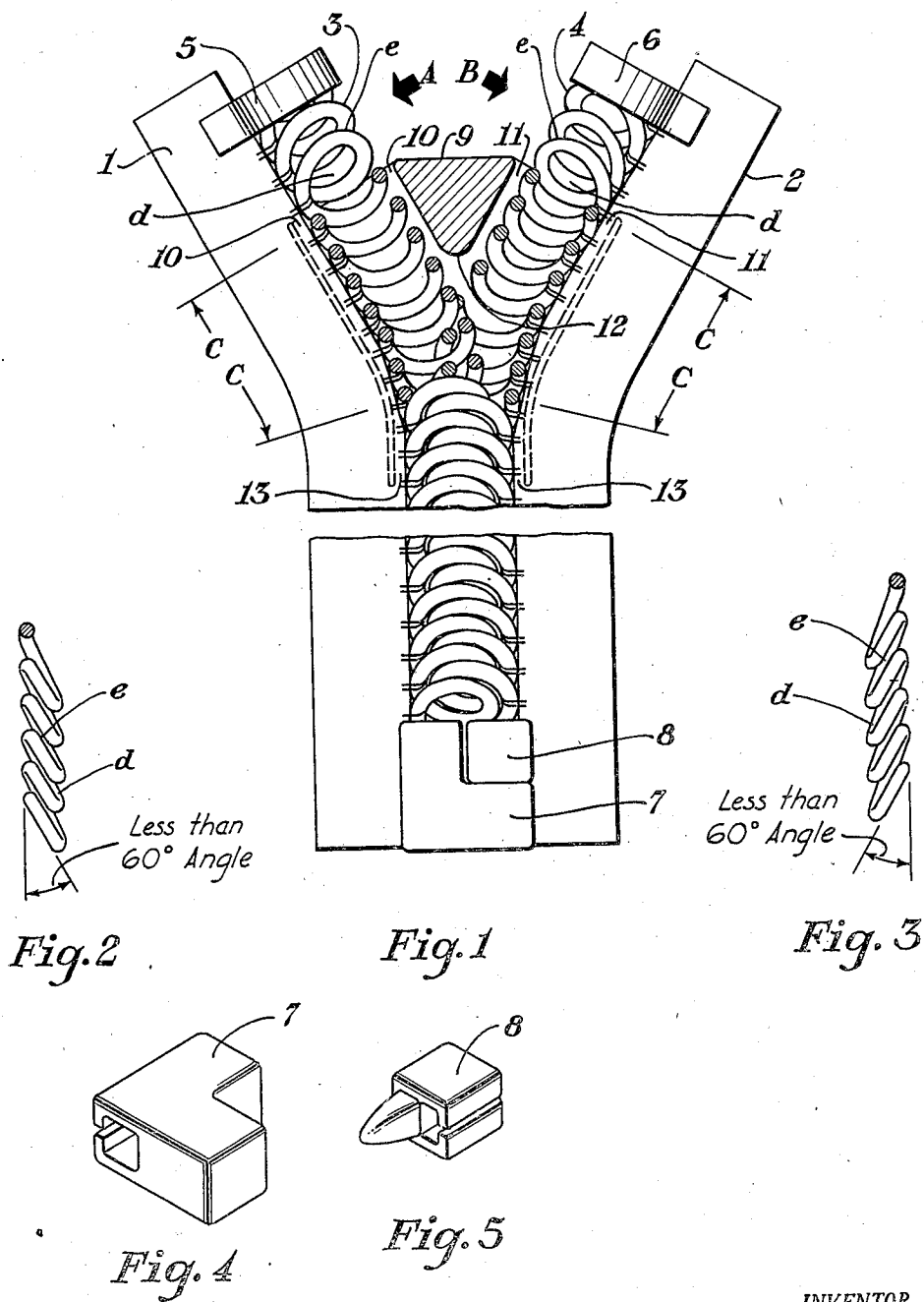
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POSITIVELY LOCKING FASTENER

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POSITIVELY LOCKING FASTENER

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This invention concerns certain improved fasteners of the type comprising a pair of continuous coils capable of being intermeshed so as to resist separation by a transverse pull and capable of being fastened together and unfastened by movement of a slider lengthwise thereto. It particularly concerns such fasteners wherein the intermeshed coils, even when constructed of filaments of uniform circular cross section, are positively interlocking, i. e., the coils are shaped and arranged so as to afford a solid barrier against unfastening by a transverse pull.

A number of slide fasteners of the general type comprising a pair of oppositely wound coils capable of being intermeshed are already known. The simplest of such known fasteners comprises as its fastening members a pair of similar, but oppositely wound, helical open spring coils as obtained by winding wire of uniform cross-section on a mandrel. Each coil is wound and is attached to a tape or stringer, forming a border of the slit or other opening to be closed, in such position that the lengthwise spacing between the successive turns of the one coil is slightly less than the diameter of the wire of the other coil, in order that the intermeshing portions of each coil may be squeezed between corresponding portions of the other coil so as to create a frictional resistance to unmeshing of the coils by a transverse pull. Since such simple coil fastener resists opening by friction only and since even slight bending of the intermeshed coils is likely to reduce or eliminate the frictional seizure and cause unfastening, this simple fastener is poorly suited to most purposes.

In order to cause positive interlocking of such spring coil fasteners, it has heretofore been proposed either to swage the inner portion of at least one of the coils so as to produce a lip or other projection which will extend lengthwise within, and will positively interlock with, the mating coil, or to cause a transverse bend in at least one coil so as to form a hook which will positively interlock with the other coil. Another proposal has been to notch the coils transversely at the points where they intermesh so as to produce between the notches on a turn of each coil a knob or projecting lip which will afford positive interlocking with the other coil. The notches serve of course as gates through which the filament of the mating coil may project. The manufacture of these previously known positively interlocking coil fasteners involves extra swaging, notching, or bending operations, which add to the cost of the products and which must be exe-

cuted with precision if the fastener is to operate smoothly. Also, most interlocking coil fasteners heretofore known have a mechanical appearance that is not particularly pleasing.

5 An object of this invention is to provide positively interlocking coil fasteners which are simple and inexpensive to make, which have a pleasing appearance, and which provide for positive interlocking of the fastener members even when the fastener as a whole is flexed or bent. Other objects will be apparent from the following description of the invention.

10 I have discovered that whereas the simplest of the above-mentioned fasteners, i. e., that wherein the interlocking members are a pair of helical coils made up of wire or other filament of uniform circular cross section, is not positively interlocking in the sense of affording a solid barrier against unfastening by a transverse pull, but instead depends upon friction only to resist such unfastening, it may be rendered positively interlocking by pressing each coil, or preferably the two coils while intermeshed, in such manner as to cause one side of each coil to move lengthwise and nearer to the opposing side so as to give the coil, or the two intermeshed coils, an oval rather than circular cross-section in the plane perpendicular to the axis of the coil or coils. When the coils are so shaped while intermeshed with one another, they are pressed along the edges lying in a plane substantially parallel to that formed by the axes of the two coils. The pressing is done, of course under conditions and in a manner such as to cause each coil to assume as its natural form, i. e., its form while not subject to an externally applied distorting force, the configuration into which it has been pressed.

The convolutions of each coil are thus caused to lie adjacent and substantially parallel to one another, but with the axis of the entire coil neither perpendicular to nor parallel with the mean transverse plane of any single convolution. Usually the minimum angle between the axis of the entire coil and the mean transverse plane of one of its convolutions is less than 60 degrees and in most instances between 20 and 45 degrees, but this angle varies somewhat with changes in the diameter of the filament making up the coil and the width or diameter of the coil as a whole.

50 The pressing operation causes some, but not great, distortion of the individual convolutions, e. g., away from an original circular form. After being pressed as above described the filament, when viewed from a point perpendicular to the mean transverse plane of a convolution of the

coil, appears to cross itself at one point in each convolution. At this point the portions of the filament which appear to cross may be in contact with one another and are usually at a distance from one another which is less than the diameter of the filament of the mating coil. At another point in each convolution of a coil the filament contacts or nearly contacts the adjacent convolution of the same coil. Here, also, the distance between the adjacent convolutions is less than the diameter of the filament of the mating coil. However, between these two points of close proximity the adjacent convolutions are spaced further apart, thus forming gates or openings through which the filament of the mating coil may project when the two coils are intermeshed. The inner portions of the adjacent convolutions of a coil which are in contact or close proximity to one another serve as mechanical barriers which resist unfastening of the intermeshed coils by a transverse pull and thus render the coils positively interlocking. In addition to this mechanical barrier, there is of course considerable frictional resistance to such unfastening.

The coils which constitute the interlocking members of the fastener are oppositely wound and are preferably of substantially the same pitch and diameter. The filament making up the coil is preferably of metal, e. g., nickel or a corrosion resistant steel, etc., but it may be of any of a variety of organic plastic materials, e. g., a solid polymer of styrene, vinyl chloride, vinylidene chloride, or methyl methacrylate, etc., or a resinous co-polymer of such compounds with any other unsaturated organic compound. The filament is usually of circular cross section, but it may be of non-circular cross section, e. g., oval, rectangular or hexagonal, etc. The filament should be sufficiently stiff and elastic to retain its shape after being formed, but is preferably sufficiently flexible so that it may be bent without breaking.

In preparing a coil member of the fastener from a filament of one of the above-mentioned thermoplastic materials, the filament is wound while hot and plastic around a mandrel, the cross section of which is usually circular but may be oval or of other desired shape. The coil is removed from the mandrel, placed alongside a similar but oppositely wound coil and the two coils are intermeshed by pressing them together in such manner that the convolutions of one coil are sandwiched between the corresponding successive convolutions of the other coil. The intermeshed coils are heated, if necessary, to a temperature at which they are plastic and are pressed while hot in such manner as to tilt, not crush; the convolutions of the coils away from a mean transverse plane approximately perpendicular to the main axes of the coils and into a plane having a minimum angle of far less than 90 degrees and usually less than 45 degrees, between it and the main axes of the coils. If desired, the intermeshed coil may advantageously be pressed while hot with sufficient force to cause a slight indentation or notching of the filaments at the points where they cross, but this is not required. After being pressed, the coils are cooled, whereby they are caused permanently to assume as their natural shape the configurations into which they have been pressed. Coil members of a metal wire may be prepared by similar general procedure, except that the conditions of temperature, applied pressure, etc., are of course adjusted so

as to give the coils the form into which they are pressed and after being pressed the coils are tempered if necessary to give them the desired resilience.

The coil members of the fastener may be formed by mechanical operations other than those just described. For instance, the two mating coils may be wound simultaneously but in opposite directions on a single mandrel, in which case they are formed in the desired intermeshed position, and the intermeshed coils may be removed endwise from the mandrel and be pressed into the final configuration desired. Alternatively, each coil may be wound separately and be pressed to tilt its convolutions as hereinbefore described, after which the oppositely wound coils may be fitted together. Other ways in which the mechanical operations for forming or shaping the coil members may be varied will be apparent from the foregoing to those skilled in the art.

The oppositely wound coils may be attached in any of the usual ways to the goods to be joined thereby. Each convolution of such coil may be sewn onto the edge of the material from which it extends, or may be interwoven with the material at one edge, or may be affixed to the material by an adhesive, etc. The coils may be fitted into a usual slider of the type having a main channel which branches in Y-shaped manner into two separate channels and the fastener may readily be fastened or unfastened by movement of such slider lengthwise thereto. The slider for opening and closing the fastener may be operated from either end of the latter and, if desired, two sliders, operable from opposing ends, may be used on the fastener.

The fastener as a whole, when closed, has a pleasing braid-like appearance. It remains positively interlocked even when flexed or bent quite sharply, e. g., by 90 degrees or more. Although the intermeshed coils may be forced apart by a strong transverse pull, such mode of opening is resisted both frictionally and by the solid barriers afforded due to the shape of the coils, i. e., such forcible separation is possible only when the transverse pull exerted is so strong as to distort temporarily one or both coils.

Fig. 1 of the drawing is a frontal view of an embodiment of the invention, certain parts being shown in cross section. Fig. 2 is a side view of the coil 3, as seen from a central position between the coils in the direction indicated by the arrow A in Fig. 1. Fig. 3 is a similar side view of the coil 4 as seen in the direction indicated by the arrow B in Fig. 1. Figs. 4 and 5 are perspective views of the clasp members at the lower ends of the respective stringers in Fig. 1.

In Fig. 1 the numerals 1 and 2 designate the tapes or other fabrics to which the interlocking coils 3 and 4 are attached. The upper portions of the stringers are shown in unengaged positions, i. e., spread apart, whereas the lower portions are shown in engaged positions, i. e., with the coils interlocked. The upper ends of coils 3 and 4 are engaged in clasps 5 and 6, respectively, which clasps are suitably attached to the tapes as indicated. The lower end of coil 3 terminates adjacent to the scoop 7 and the lower end of coil 4 terminates at clasp 8. Section C—C of Fig. 1, which includes a usual slider 9 for causing interlocking or unfastening of the coils 3 and 4, is shown in cross section. Slider 9 is provided with channels 10 and 11 for the coils 3 and 4, respectively. The channels 10 and 11 merge at fork 12 into the single channel 13.

As hereinbefore mentioned, the interlocking coils 3 and 4 are oppositely wound and are substantially mirror images of one another, i. e., except for being wound in opposite directions they are of similar size and shape. The successive convolutions of each coil lie adjacent and parallel to one another, but each convolution is tilted with respect to the axis of the coil, e. g., the minimum angle between the axis of the coil and the mean transverse plane of a convolution of the coil is preferably less than 45 degrees.

Because of its shape and the tilting of its convolutions there are provided in each coil a series of gates or openings between its successive convolutions through which the filament of the mating coil may project, and also mechanical barriers to resist unfastening of the intermeshed coils by a transverse pull. In Figs. 1-3, the symbols *d* indicate such gates for the filament of the mating coil and at the points marked *e* the distance between adjacent convolutions of a coil is less than the diameter of the filament of the mating coil so that a barrier is provided to resist unfastening of the intermeshed coils by a transverse pull. When each coil is bent, e. g., as by the action of the slider 9 in section C-C of Fig. 1, the inner portions of the adjacent convolutions of a coil, e. g., the portions at the point marked *e*, are spread apart to permit passage of the filament of the mating coil through the resultant opening. Consequently, the coils are readily intermeshed or unmeshed by movement of the slider 9 lengthwise thereto.

The mode of opening or closing the fastener by means of a slider will be apparent from Fig. 1 of the drawing. As the slider 9 is raised, the convolutions of coils 3 and 4 slide over one another and nest together in an interlocked position. The fastener is fully locked when slider 9 is raised to the clasps 5 and 6. It is unlocked when slider 9 is lowered so as to encompass clasp 8 and scoop 7. When in this position clasp 8 may be withdrawn through channel 11 of the

slider, thus fully disengaging the goods to which coils 3 and 4 are attached. For refastening, clasp 8 is reinserted in scoop 7 by way of the channel 11 in slider 9 and the latter is raised.

Although I have in this application shown and described certain embodiments of my invention, it will be understood that these embodiments are merely illustrative and that other forms may be devised within the scope of the following claims.

I therefore particularly point out and distinctly claim as my invention:

1. A fastener comprising as the interlocking members thereof a pair of oppositely wound coils capable of being mated with one another, the successive convolutions of each coil lying adjacent to one another in substantially parallel transverse planes but with each convolution tilted so that the minimum angle between the axis of the coil and the mean transverse plane of each convolution of the coil is not greater than 60 degrees and so that when the axis of a coil corresponds to a straight line the distance between adjacent convolutions of the coil is less than the diameter of the filament of the mating coil at a point other than that at which the filament of the coil, when viewed at the wider side of the latter, appears to cross itself in extending from one convolution of the coil to the next, and adjacent convolutions are separated by a distance at least as great as the diameter of the filament of the mating coil at a point along the wider side of the coil.

2. A fastener as described in claim 1 wherein the filament of each coil is of substantially uniform circular cross section.

3. A fastener as described in claim 1 wherein the filament of each coil is of substantially uniform circular cross section and the minimum angle of tilt of the convolutions of each coil with respect to the axis of the coil is between 20 and 45 degrees.

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