

[54] COIL SPRING WIRE GUIDE

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[51] Int. Cl.² A61M 25/00

[58] Field of Search 128/2 M, 2.05 R, 4-7, 128/341, 348-351, DIG. 9

[56] References Cited

UNITED STATES PATENTS

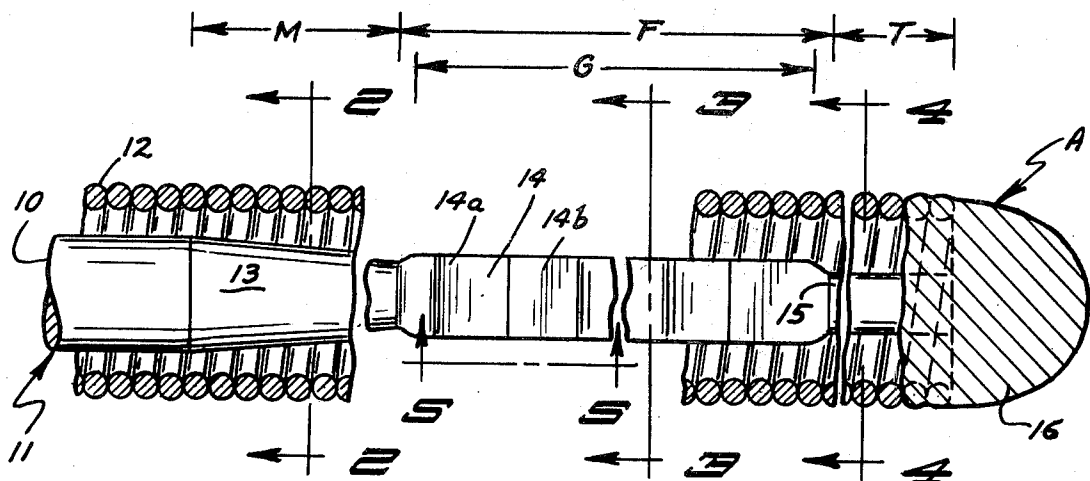
3,452,742	7/1969	Muller.....	128/2 M
3,521,620	7/1970	Cook.....	128/2.05 R
3,528,406	9/1970	Jeckel et al.....	128/2.05 R

Primary Examiner—Dalton L. Truluck
Attorney, Agent, or Firm—Dugger, Johnson & Westman

[57] ABSTRACT

A coil spring guide, for use in connection with the insertion of catheters into the vessels of a body, that has a coil spring, and a wire core extending within the coil spring and having a distal end welded to the distal end of the coil spring. The wire core throughout the major portion of its length is cylindrical while the end portion adjacent where the core is welded to the distal end of the coil spring is flattened to in transverse cross section be of a substantially larger dimension in one direction than in a direction at right angles thereto, and as viewed from the edge thereof, along a major part of the length of the flattened portion is of an undulated shape.

9 Claims, 7 Drawing Figures



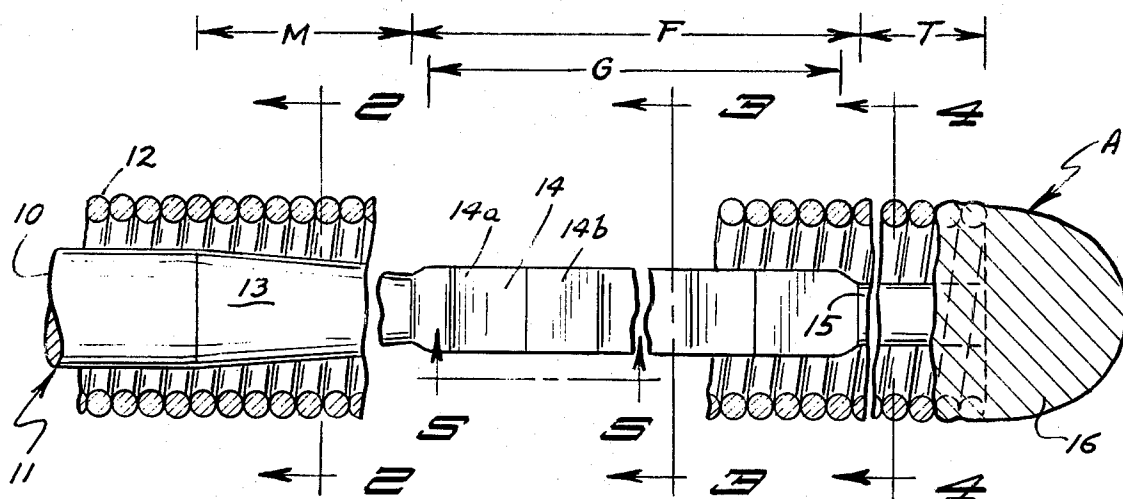


FIG. 1

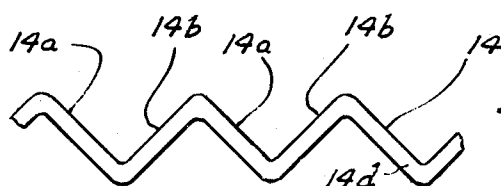


FIG. 5

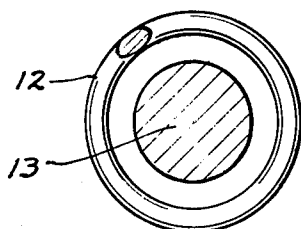


FIG. 2

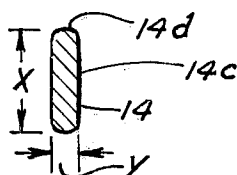


FIG. 3

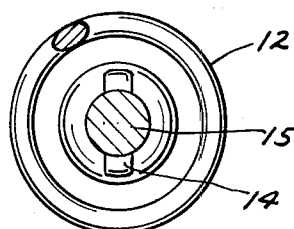


FIG. 4

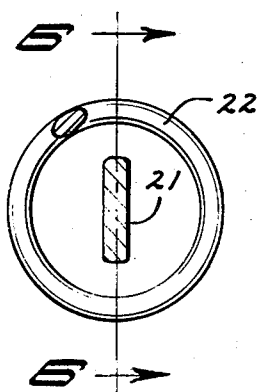


FIG. 7

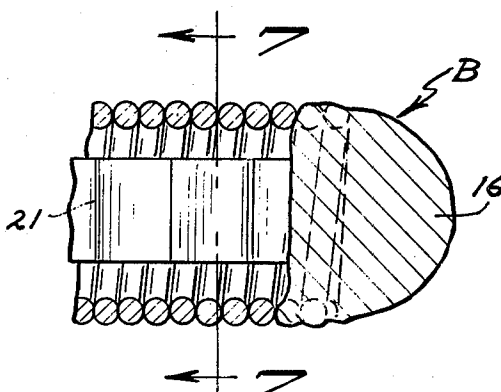


FIG. 6

COIL SPRING WIRE GUIDE

BACKGROUND OF THE INVENTION

A coil spring guide for use in connection with the insertion of catheters into the vessels of a body.

Prior art coil spring guides include those such as disclosed in U.S. Pat. Nos. 3,542,742, 3,521,620, 3,528,406 and 3,547,103. For some uses, the inside diameter of the coil spring is too small for having two wires extend into or through the distal end portion such as disclosed in the above mentioned patents and the wire core breaks on occasion due to winding of the guide in a coil or usage thereof and the resulting stretching force exerted on the distal end portion thereof. In order to overcome problems such as the above, as well as others, together with providing a wire core having the desired strength and flexibility and be of one piece construction, this invention has been made.

SUMMARY OF THE INVENTION

A coil spring guide having a coil spring and a wire core having a distal end welded to the distal end of the coil spring, the wire core having the major portion thereof of a cylindrical shape and a distal end portion that is undulated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross sectional view of the first embodiment of the invention, the proximal end portion and a longitudinally intermediate part of the guide not being shown;

FIG. 2 is a transverse cross sectional view through the tapered part of the wire core and radially adjacent part of the coil spring, said view being generally taken along the line and in the direction of the arrows 2—2 of FIG. 1;

FIG. 3 is a transverse cross sectional view, generally taken along the line and in the direction of the arrows 3—3 of FIG. 1, of the flattened part of the wire core;

FIG. 4 is a transverse cross sectional view generally taken along the line and in the direction of the arrows 4—4 of FIG. 1 longitudinally between the flattened part of the wire core and the welding of the core to the coil spring;

FIG. 5 is a fragmentary longitudinal sectional view of the flattened portion of the wire core to show the generally undulated shape thereof;

FIG. 6 is a fragmentary longitudinally cross sectional view, generally taken along the line and in the direction of the arrows 6—6 of FIG. 7, of the distal end portion of the coil spring guide of the second embodiment; and,

FIG. 7 is a transverse cross sectional view through the flattened end portion of the wire core and coil spring of the distal end portion of the coil spring guide of the second embodiment, said view being generally taken along the line and in the direction of the arrows 7—7 of FIG. 6.

Referring now to FIGS. 1—5, the coil spring guide of the first embodiment, generally designated A, includes a tightly wound coil spring 12 that for many uses is of a length of at least 150 cm. but can be of other lengths, and preferably is made of stainless steel. The outside diameter of the coil is usually about 0.018 inch to 0.045 inch although it may be of other diameters, while the diameter of the wire of the coil spring usually is in the range of 0.004 to 0.010 inch. Extending within the

coil spring is a wire core, generally designated 11. The wire core, which preferably is of stainless steel, includes an axially elongated cylindrical portion 10 that usually is of a diameter of about 0.008 inch to 0.022 inch. The distal end of cylindrical portion 12 is integrally joined to the distal end portion of the wire core, the distal end portion of the wire core including an axially elongated portion 13 having a major base end integrally joined to the distal end of cylindrical portion 10 and a minor base end integrally joined to one end of the elongated flattened portion 14. The opposite end of the flattened portion is integrally joined to one end of the terminal end portion 15 of the wire core. The opposite end of the terminal end portion is rigidly attached to the distal end of the coil spring at 16. The terminal end portion 15 is of an axially elongated cylindrical shape and of substantially the same diameter as the minor base of the frusto conical portion 13. The flattened portion throughout substantially the entire length thereof, i.e., for the length G, is of a nearly rectangular transverse cross section such as indicated in FIG. 3. That is, along length G, portion 14 has generally flat, opposed, generally planar surfaces 14c that are each of a transverse dimension X and slightly rounded edge surfaces 14d that are each of a dimension Y at generally right angles to surfaces 14c. The dimension X is many times greater than dimension Y, preferably about 3 to 5 times as great. The opposite ends of portion 14, part of each side of the part indicated by dimension G, is gradually sloped to form the transition to the cross sectional shape of the adjacent end or portions 13 and 15, respectively.

Additionally, the flattened portion 14 along substantially the entire length, or at least a major portion of the length of G, is of a generally undulated shape when looking toward one edge 14d thereof, see FIG. 5. Thus portion 14 is bent about transverse axes parallel to the width dimension X (axis perpendicular to the direction of elongation of portion 14) to provide sections 14a that extend predominately in one direction and sections 14b that extend predominately in a second direction whereby each set of joined sections 14a, 14b are generally "V" shaped when viewed from the edge of portion 14. Thus the linear length G of the flattened portion is considerably less than the total length of the flattened portion that extends through dimension G.

The second embodiment of the invention, generally designated B, is of the same construction as the first embodiment except for portions 14, 15. Rather the flattened portion 21 for the wire core of the second embodiment is of the same length as the combined lengths of portions 14, 15, is welded at 16 to the coil spring 12 of the second embodiment, and is undulated in the same manner as portion 14. Usually the first embodiment is preferred since the cylindrical end portion 15 is easier to weld to the coil spring than a generally rectangular portion 21 that has a transverse width many times greater than its thickness.

In making the wire core, preferably the wire core blank is one continuous length of metal that is ground down to a cylindrical shape portion of a sufficient length, that when bent to form undulated portions 14a, 14c, provides portion 14 of a length F joined to the minor base of portion 13 plus the length T of the portion 15, and is of the same diameter as portion 15. The last mentioned cylindrical portion is then shaped to provide a straight, elongated planar flattened portion

which is then bent to provide portion 14 having the undulations. Thus the wire core is a continuous, unitary piece of metal having no junctions therein, but that is rigidly attached at the distal end of the coil spring, and may or may not have its proximal end welded to the proximal end of the coil spring.

The coil spring and wire core in a relaxed condition are straight, i.e., having the undulations but no permanent set in either so that neither one or the other or both of them tend to assume a predetermined curved configuration. If the wire core along portion 14 were of the same cross sectional configuration as portion 15 and were of a diameter of about 0.006 inch, when the distal tip of the guide hits an obstruction in the vessel, the distal end portion bends and the distal end portion of the guide frequently will not snap back completely. On the other hand, if the wire core along portion 14 were the same cross sectional configuration as portion 15 and were of a diameter of about 0.004 inch, the guide distal end after hitting an obstruction in the vessel, for example a branch blood vessel, if bent, would snap back; however, the distal end portion of the wire core would not be strong enough for safety purposes. A coil spring guide having such a 0.004 inch cylindrical portion has the flexibility but not the desired strength, whereas the coil spring guide having the 0.006 inch cylindrical shape just previously referred to has the strength but not the desired flexibility and memory. With the present invention, portion 14, which has a transverse width X many times greater than the transverse thickness Y, if relatively flexible insofar as bending about axes parallel to surfaces 14c, but relatively stiff insofar as bending about axes perpendicular to surfaces 14c. However, if the guide is being inserted in a blood vessel and due to the bending of the blood vessel is urged to bend in a direction of the greatest stiffness of portion 14, due to the length of the wire core, the core will twist sufficiently that portion 14 bends about axes generally parallel to surface 14c.

Due to the provision of the undulations in portion 14, when the spring guide A or B is wound in a coil, portion 14 elongates sufficiently to prevent breakage of the wire core, which happens on occasions when no undulations are provided in the wire core. Also, due to the undulations, portion 14 can elongate (stretch in length) sufficiently during usage that it is much less likely to break than a wire core that does not have such undulations. During the stretching, the angles formed by the adjacent joined sections 14a, 14b increases, i.e., the effective length of portion 14 increases but the actual length of wire forming portion does not increase.

As an example of the invention but not otherwise as a limitation thereon, the outside diameter of coil 12 may be 0.018 inch to 0.045 inch, the wire coil 12 of a diameter of about 0.004 inch to 0.010 inch, portion 10 of a diameter of about 0.008 inch to 0.022 inch, portion 13 of a length of about 2.5 cm. or longer, portion 14 in a relaxed undulated condition of a length of about 3.5 cm., portion 15 of a diameter of about 0.006 inch and a length of about one-eighth inch to three-sixteenths inch, and portion 14 having an X dimension of about 0.010 inch and a Y dimension of about 0.0025 inch.

The coil spring guide of this invention is used for inserting catheters in a body vessel, and as the use of spring guides has been described in the prior art, for example, U.S. Pat. No. 3,528,406, Col. 1, lines 20-38, a

description of the use thereof will not be further set forth.

What is claimed is:

1. A vascular coil spring guide comprising an elongated coil spring having a distal end portion that has a distal end and an elongated wire core extending within the coil spring that has an elongated distal end portion within the coil spring distal end portion and a distal end, said wire core distal end portion having a plurality of undulations that are bent about axes that are generally perpendicular to the direction of elongation, said distal ends being fixedly secured to one another.

2. The apparatus of claim 1 further characterized in that the wire core distal end portion includes an elongated flatten portion that is generally rectangular in transverse cross section.

3. The apparatus of claim 2 further characterized in that said flatten portion has the wire core distal end.

4. The apparatus of claim 2 further characterized in that said wire core has a cylindrical portion that has one end integrally joined to the flatten portion and an opposite end, said opposite end comprising the wire core distal end.

5. The apparatus of claim 2 further characterized in that said wire core has a generally cylindrical shaped, elongated portion that has a distal end integrally joined to the wire core distal end portion and that is of a larger transverse cross sectional area than the maximum transverse cross sectional area of wire core distal end portion at a location substantially spaced from said cylindrical shaped, elongated portion.

6. The apparatus of claim 2 further characterized in that the wire core is a continuous length of unitary formed metal.

7. The apparatus of claim 2 further characterized in that the transverse width of the flatten portion is many times greater than the transverse thickness thereof and said distal ends are secured by being welded to one another.

8. A vascular coil spring guide having an elongated metal coil spring that has a first portion, and a distal end portion that has a distal end and is joined to the coil first portion, and an elongated metal wire core within the coil spring that has an elongated first portion within the coil spring first portion, and a distal end portion within the coil spring distal end portion that has a distal end, the wire core distal end portion having a second portion that is joined to the wire core first portion and is of a reduced transverse cross sectional area in a direction away from the wire core first portion, and an elongated flatten portion joined to said second portion to extend away therefrom in a direction away from the wire core first portion, said flatten portion being bent about a plurality of axes generally parallel to the direction of elongation of the flatten portion to provide a plurality of undulations, and a weld joining the distal ends.

9. The apparatus of claim 8 further characterized in that said wire core is a continuous single unitary integral length of wire, and that the transverse width dimension of the flatten portion is many times greater than the thickness thereof, said axes being generally parallel to said transverse width dimension, and that the maximum cross sectional area of the flatten portion is less than the wire core first portion that is adjacent said second portion.

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