

[54] **SPRING GUIDE WITH FLEXIBLE DISTAL TIP**

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[58] Field of Search **128/2 M, 2.05 R, 128/348, 349 R, 350 R, 351, DIG. 9, 4-7, 341**

[56] **References Cited**

UNITED STATES PATENTS

3,612,058 10/1971 Ackerman..... 128/2.05 R

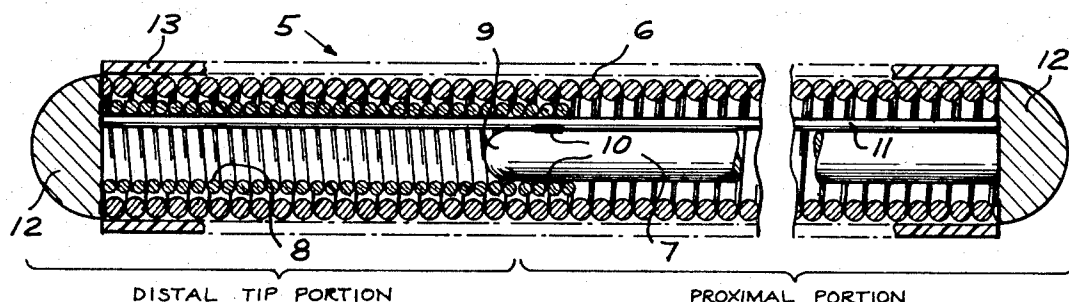
3,552,384 1/1971 Pierie et al..... 128/2.05 R
3,547,103 12/1970 Cook..... 128/2.05 R

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[57] ABSTRACT

This invention is directed to a spring guide having an elongated helically wound spring body and a composite internal core constructed to enable the distal tip portion of the spring guide to flex readily without kinking while retaining its ability to return to its normally unflexed condition after having been flexed. The composite core comprises proximal and distal portions in which the distal portion may be relatively more flexible than the proximal portion and corresponds in length to the distal portion of the body spring. Preferably, the distal end portion of the composite core is formed as a helical spring coiled counter to that of the body spring.

10 Claims, 3 Drawing Figures



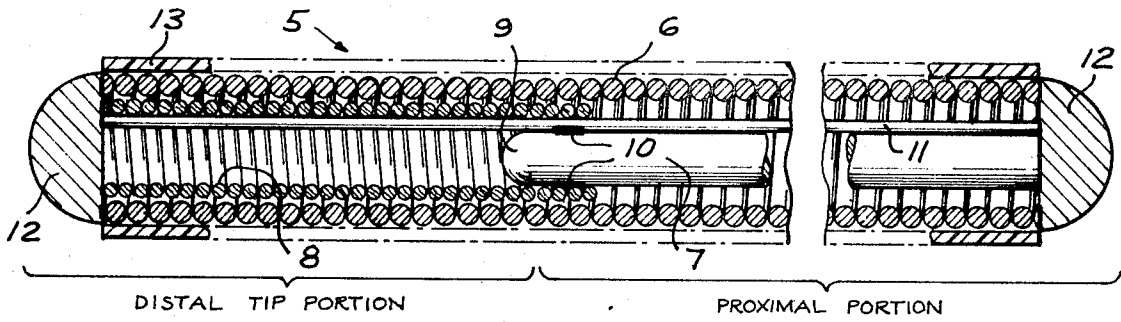


FIG. 1

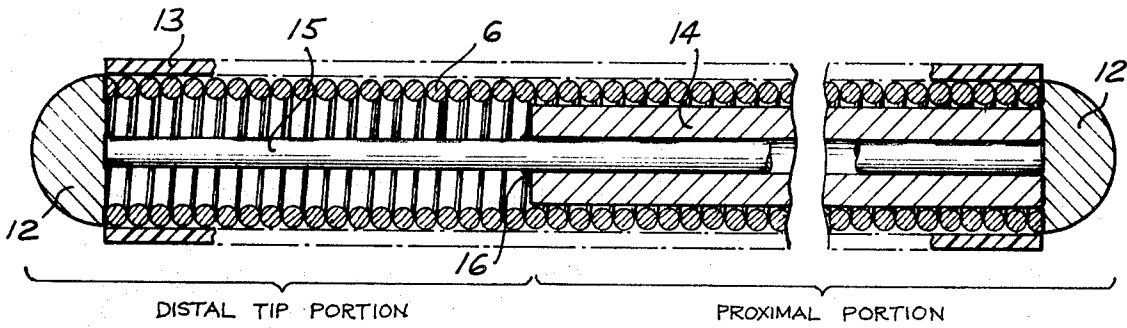


FIG. 2

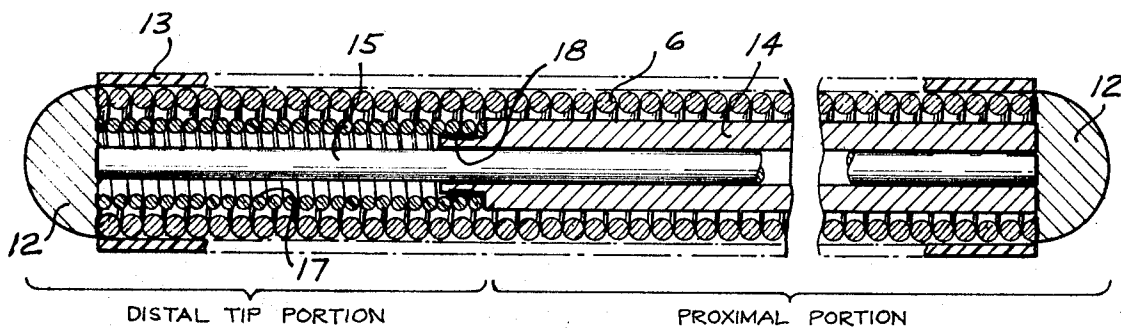


FIG. 3

SPRING GUIDE WITH FLEXIBLE DISTAL TIP

THE INVENTION

This invention relates generally to new and useful improvements in spring guides of the types currently used in cardiac and vascular surgery for the proper guidance and positioning of complementing types of catheters when advanced thereover, and particularly seeks to provide a novel spring guide having a reinforced but still flexible distal tip.

Although spring guides and their complementary catheters of various constructions and various materials broadly have been known and used for some time, it has been only relatively recently recognized that, in the techniques involved, the distal tip of a spring guide must be so constructed as to remain adequately flexible while at the same time be able to avoid becoming kinked or otherwise more or less permanently deformed as the result of any unforeseen resistance to its advance through a vein or artery.

It is believed that the importance of this problem will be better understood following a brief description of the techniques involved.

Currently, such techniques involve the percutaneous insertion of a sharpened cannula into the lumen of a vein or other vessel, after which the distal end of the spring guide is inserted therethrough and the cannula withdrawn. The advance of the spring guide is controlled through fluoroscopic observation until the guide has reached the desired ultimate position of advance, and thereafter a catheter of the required type is inserted thereover and the spring guide is retracted. Obviously the distal end of the spring guide must be sufficiently flexible to follow the curvatures and branches of the vessels being catheterized without becoming subject to resistance-caused kinking while the entire less flexible proximal length of the spring guide must be sufficiently stiff as to permit its advance solely through manipulative forces applied from the proximal end. Generally, the stiffness of the spring guide for manipulative purposes has been attained through the use of a full length core wire which, unfortunately, has also added undesirable stiffness to the distal tip. Furthermore, since these types of spring guides are constructed as coil springs, the wire of the helices thereof may become broken due to inadvertent over stressings or distortions, thus requiring the presence of a so-called safety wire that extends the full length of the guide and whose only function is to prevent the separation of parts in the event of coil breakage.

However, the spring guide constructed in accordance with this invention overcomes such problems and includes the desirably flexible distal tip while retaining all of the safety and other physical characteristics now deemed to be necessary.

Therefore, an object of this invention is to provide a spring guide having a body formed as a continuous coiled spring with the helices thereof in contact with each other and including a flexible distal tip portion so constructed as to minimize the possibility of kinking when undergoing either axially applied compression loads or sharply applied angular loads.

Another object of this invention is to provide a spring guide of the character stated that includes a composite core extending the full length thereof and having a proximal portion extending from the proximal end of the spring guide to the proximal end of the distal tip

portion and terminating in an inner continuous coiled spring extending along the full length of the distal tip portion.

Another object of this invention is to provide a spring guide of the character stated in which the coils of the inner spring are formed in a direction opposite to those of the spring body.

Another object of this invention is to provide a spring guide of the character stated in which the distal end of the proximal portion of the composite core is generally ball-shaped and in which the proximal end of the inner spring is affixed to the distal end of the proximal portion proximally of its ball-shaped end.

Another object of this invention is to provide a spring guide of the character stated that includes an internal safety wire extending the full length thereof and having its ends rigidly affixed to the respective ends of the body thereof.

A further object of this invention is to provide a modified form of spring guide of the character stated in which the core is formed from a capillary tube extending from the proximal end of the body to the proximal end of the distal tip portion and in which the safety wire passes through the capillary tube.

A further object of this invention is to provide a further modified form of spring guide of the character stated in which the distal end of the capillary tube is provided with a coil spring extending along the full length of the distal tip portion of the body.

A further object of this invention is to provide a spring guide of the character stated that is simple in design, rugged in construction and economical to manufacture.

With these and other objects, the nature of which will become apparent, the invention will be more fully understood by reference to the drawings, the accompanying detailed description and the appended claims.

In the drawings:

FIG. 1 is an enlarged longitudinal section of a spring guide constructed in accordance with this invention;

FIG. 2 is a view similar to FIG. 1 but showing a modification of the core and distal end construction thereof; and

FIG. 3 is a view similar to FIG. 2 but showing a further modification of the core and distal end construction thereof.

Referring to the drawings in detail the invention, as illustrated, is embodied in a spring guide generally indicated 5 (see FIG. 1) that includes an elongated tubular body 6 formed from stainless wire wound as a continuous coil with the helices thereof in contact with each other. The body 6 includes a relatively long proximal portion and a relatively short distal tip portion.

A composite core is carried within the body 6 and includes a proximal wire portion 7 coextensive in length with the proximal portion of the body 6 and a distal portion 8 coextensive in length with the distal tip portion of the body. The distal end per se of the proximal core wire is hemispherically shaped (or even ball shaped) as at 9 to provide a smooth fulcrum for the distal portion 8 which comprises a continuous helical spring of opposite rotation to that of the body 6 and having an inside diameter such as to fit smoothly over the ball end of the proximal wire 7 to which it is welded or otherwise securely affixed as at 10, 10.

A safety wire 11 extends the full length of the body 6 and has its proximal portion disposed alongside the

proximal wire 7 and its distal portion passing through the inner coil spring distal portion 8 of the composite core.

A smooth generally hemispherical head 12, formed by welding, brazing or soldering, closes each of the proximal and distal ends of the body 6 and also secures the proximal and distal ends of the safety wire 11 in place as well as the proximal end of the core wire 7 and the distal end of the inner extension spring 8.

A sheathing or coating 13, formed from a suitable flexible inert plastic may be, and generally is, firmly bonded to the exterior of the body 6 and extends the full length thereof in order to complete the spring guide for use.

Through the above described construction, a spring guide is provided with a distal end portion that is sufficiently flexible to permit it readily to follow the curvatures of a vessel through which it is to be inserted, without being subject to kinking, while at the same time having the capability of returning to its normally straight configuration during passage through a straight portion of the vessel. In this connection it should be noted that the ball-shaped end 9 of the proximal wire 7 of the composite core permits the extension coil spring 8 thereof to flex about its proximal end without bending around a sharp corner; and that since the coil direction of the inner spring 8 is opposite to that of the body 6, the two spring portions are complementarily opposed and tend to cause the distal tip portion of the spring guide to more naturally return to its normal straight alignment.

Comparable results may be obtained through the modifications shown in FIGS. 2 and 3 of the drawings.

In the modification shown in FIG. 2 the outer spring body 6, the end closures 12 and the outer sheath or coating are the same as previously described. However, in this modification the composite core consists of a metallic capillary or hypodermic needle type tube 14 that extends along and within the proximal portion of the body 6 and a safety wire 15 that passes through the tube 14 and extends along the full length of the body 6. Here the safety wire 15 not only has its proximal and distal ends securely affixed to the closure beads 12, but also is welded or otherwise securely affixed to the distal end of the tube 14 as at 16.

The modification shown in FIG. 3 is similar to that of FIG. 2 except that the capillary tube 14 is provided with a helical spring distal extension 17 that has its proximal end securely affixed thereto as at 18 and its distal end securely affixed to the distal bead 12.

It will be understood from the foregoing description that, for the purposes of the mechanical or physical

constructions of the spring guides of this invention, the dimensions, wire gages and relative proportions of parts need be only those necessary to properly effect such constructions. However, keeping in mind that these spring guides primarily are intended for use in the previously described surgical procedures, it also will be understood that their external diameters, regardless of overall length, must be small enough to permit the desired sizes of catheters to be advanced thereover.

We claim:

1. A spring guide including an elongated body formed as a continuously wound helical spring, the helices of which are in contact with each other, and having a relatively long proximal portion and a relatively short distal tip portion; a composite core extending the full length of said body and comprising a proximal portion formed from a straight wire and a distal extension formed as a continuously wound helical spring substantially coextensive in length with the distal tip portion of said body, and means for closing the proximal and distal ends of said body and for securing the proximal and distal ends of said composite core.

2. The spring guide of claim 1 in which the distal end of said proximal core wire is rounded.

3. The spring guide of claim 2 additionally including a safety wire extending through the full length of said body and having its proximal and distal ends secured to the said proximal and distal end closures of said body.

4. The spring guide of claim 3 in which said safety wire passes exteriorly of said proximal core wire and interiorly of the distal extension thereof.

5. The spring guide of claim 2 in which the proximal end of said distal extension fits over the distal end of said proximal core wire and is affixed thereto proximally of the said rounded distal end thereof.

6. The spring guide of claim 1 in which the straight wire comprising the proximal portion of said composite core is replaced by a capillary tube.

7. The spring guide of claim 6 additionally including a safety wire extending along the axis of said composite core and having its proximal and distal ends secured to the said proximal and distal end closures of said body.

8. The spring guide of claim 7 in which the proximal end of said distal extension spring is affixed to the distal end of said capillary tube.

9. The spring guide of claim 1 in which said body is externally covered by an inert flexible plastic material firmly bonded thereto.

10. The spring guide of claim 6 in which said body is externally coated by an inert flexible plastic material firmly bonded thereto.

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