IMAGING TRANSDUCER ASSEMBLY

CROSS-REFERENCE TO RELATED PATENTS AND APPLICATIONS

This is a continuation-in-part of U.S. patent application Ser. No. 10/401,901, entitled "An Improved Imaging Transducer Assembly," filed on Mar. 28, 2003 now U.S. Pat. No. 7,081,094, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The field of the invention relates to medical imaging systems, and more particularly to an improved imaging transducer assembly.

BACKGROUND OF THE INVENTION

Intraluminal, intracavity, intravascular, and intracardiac treatments and diagnosis of medical conditions utilizing minimally invasive procedures are effective tools in many areas of medical practice. These procedures are typically performed using imaging and treatment catheters that are inserted percutaneously into the body and into an accessible vessel of the vascular system at a site remote from the vessel or organ to be diagnosed and/or treated, such as the femoral artery. The catheter is then advanced through the vessels of the vascular system to the region of the body to be treated. The catheter may be equipped with an imaging device, typically an ultrasound imaging device, which is used to locate and diagnose a diseased portion of the body, such as a stenosed region of an artery. For example, U.S. Pat. No. 5,368,035, issued to Hamm et al., the disclosure of which is incorporated herein by reference, describes a catheter having an intravascular ultrasound imaging transducer.

FIG. **1***a* shows an example of an imaging transducer assembly **1** known in the art. The imaging transducer **1** is typically within the lumen **60** of a guidewire (partially shown), having an outer tubular wall member **5**. The imaging transducer assembly **1** includes a coaxial cable **110**, having a center conductor wire **120** and an outer shield wire **140**, shown in FIG. **1***b*. A conductive wire, having a diameter of approximately 500 microns, is wrapped around the coaxial cable **110**, forming a coil, which functions as a drive shaft **10**. Connected to the distal end of the drive shaft **10** is a stainless steel housing **20**, which serves to reinforce the structure of the imaging transducer assembly **1**. Surrounding the coaxial cable **110**, within the housing **20** is a silver epoxy **30**, a conductive material. Thus, the housing **20** is electrically coupled to the shield wire **140** of the coaxial cable **110** via the epoxy **30**. On the distal end of the silver epoxy **140** is an insulating substance, a non-conductive epoxy **35**.

On the distal end of the non-conductive epoxy **35** is a layer of piezoelectric crystal ("PZT") **80**, "sandwiched" between a conductive acoustic lens **70** and a conductive backing material **90**, formed from an acoustically absorbent material (e.g., an epoxy substrate having tungsten particles). The acoustic lens **70** is electrically coupled with the center conductor wire **120** of the coaxial cable **110** via a connector **40** that is insulated from the silver epoxy **30** and the backing material **90** by the non-conductive epoxy **35**. The backing material **90** is connected to the steel housing **20**. It is desirable for the imaging transducer assembly **1** to be surrounded by a sonolucent media. Thus, the lumen **60** of the guidewire is also filled with saline around the assembly **1**. The driveshaft **10**, the housing **20**, and the acoustic lens **70** are exposed to the saline. During operation, the PZT layer **80** is electrically excited by both the backing material **90** and the acoustic lens **70**. The backing material **90** receives its charge from the shield wire **140** of the coaxial cable **10** via the silver epoxy **30** and the steel housing **30**, and the acoustic lens **70**, which may also be silver epoxy, receives its charge from the center conductor wire **120** of the coaxial cable **110** via the connector **40**, which may be silver epoxy as well.

The imaging transducer assembly is generally a rigid structure; however, the vessels through which the assembly is typically advanced are often tortuous, which create tight radii within the catheter. Thus, it is desirable to have the rigid portions, such as the imaging transducer assembly, of the catheter be relatively small in length.

Accordingly, an alternative transducer assembly may be desirable.

SUMMARY OF THE INVENTION

The improved imaging device is intended for use within the lumen of a human body, e.g., the lumen of a blood vessel. Generally, the imaging device is coupled to the distal end of a drive shaft, and a conductive wire is wrapped around a distal portion of the drive shaft.

In one embodiment of the improved imaging device, the conductive wire is part of a sensor adapted to communicate with a medical positioning system.

In another embodiment of the improved imaging device, the conductive wire is configured to be a matching circuit for the imaging device.

Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the scope of the invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better appreciate how the above-recited and other advantages and objects of the present inventions are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof, which are illustrated in the accompanying drawings. It should be noted that the components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views. However, like parts do not always have like reference numerals. Moreover, all illustrations are intended to convey concepts, where relative sizes, shapes and other detailed attributes may be illustrated schematically rather than literally or precisely.

FIG. **1***a* is a cross-sectional side view of an imaging transducer assembly known in the art;

FIG. **1***b* is a cross-sectional view of the coaxial cable within the prior art imaging transducer assembly of FIG. **1***a;*

FIG. **2***a* is cross-sectional side view of an imaging transducer assembly in accordance with an example embodiment of the invention;

FIG. **2***b* is a cross-sectional view of a coaxial cable within the imaging transducer assembly of FIG. **2***a;*

FIG. **3***a* is a simplified diagram of an electrical circuit formed by the imaging transducer assembly of FIG. **3***a;*