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Fabrication Method For eCoil Conductors And Associated Circuitry

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This invention provides a method of fabricating radio frequency (RF) coils of the type used during magnetic resonance imaging (MRI) procedures to produce high resolution images of the interior of the human body.

SPECIFICATION

As compared to conventional methods of making such coils, the method outlined here will not only simplify and reduce the cost of constructing RF coils and associated circuitry but also increase the reliability of such coils.

The invention may also potentially improve the performance of RF coils made according to the method. This improvement should be realized at least partly due to the fact that coils made by this method will be thin and flexible. With these complementary characteristics, an RF coil can be made to conform more closely to the contour of the body part to be imaged. This will place the conductors of the RF coil closer to the tissue, thus enabling the conductors to more readily detect the faint magnetic resonance (MR) signals induced in the tissue during MRI imaging procedures.

Rather than using conventional wire and discrete components such as chip capacitors, RF coils made using this method will be fabricated from a thin two-sided printed circuit material such as CuFlon® manufactured by CRANE Polyflon Company, a Duroid® microwave laminate manufactured by Rogers Corporation, or certain other types of flexible substrate. More specifically, the method will require the copper layer on one side of the two-sided laminate to be etched in pattern to form the conductor loop geometry desired for the particular type of RF coil being produced. This replaces the wire, copper foil, copper tape, printed circuits and other materials typical of conventional methods of making RF coils. The other side of the laminate should be strategically etched relative to the conductor pattern on the first side to form therewith the capacitors of the RF coil as well as the tuning and/or impedance matching networks.

By strategic etching of the copper layers on opposite sides of the laminate, the method permits formation of the conductor loops and the required circuit elements directly upon the two-sided substrate material. This eliminates the need for discrete circuit components such as chip capacitors, which are typically used to make conventional RF coils. The elimination of discrete components means that few, if any, solder joints will be required, and the elimination of solder joints will make the resulting RF coils even more flexible. The two-sided substrate thus allows the formation of the conductor patterns, the inductors and the capacitors completely out of the substrate material itself, and its thinness and flexibility allows the coil structure to conform to the desired shape. This method is thus ideal for use in making coils for imaging within small internal

cavities of the body (e.g., endorectal coils known as eCoils). It is also equally well suited for fabrication of larger RF coils for use in imaging virtually all other parts of the anatomy.