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EXTERNALLY-COUPLED TRANSCUTANEOUS ENERGY TRANSMISSION SYSTEM FOR A TOTALLY IMPLANTABLE ARTIFICIAL HEART

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This paper reports an externally-coupled coil system that is used for transmitting energy transcutaneously to a totally implantable artificial heart. The internal coil is embedded under the skin, with part of it protruded from the body surface in the shape of an arch. A CC type ferrite core is inserted into the circular aperture surrounded by the arch, and the external coil is tightly wound on the core. Close coupling of magnetic flux and, therefore, high efficiency and stability of operation can be attained with this coil construction. The close coupling also means that the leakage of the flux is quite little to cause undesirable influence on the organisms and electrical equipment in the neighborhood. An animal experiment was carried out with this coil system attached to a grown-up goat. With a load simulating an artificial heart that consumes an average power of 20W with the driving voltage of 22.5V, efficiencies of the energy transmission were found to be 76% (ratio of power consumption of the load simulator to the DC input), 84% (ratio of AC input to the external coil to the DC input), and 90% (ratio of power consumption of the load simulator to the AC input to the external coil), respectively. Reduction in the efficiency due to movement of the animal was less than 3%. Temperature during the operation was less than 38°C at the portion of the external coil where the core is in contact with the internal coil covered with the skin.

In practical use, this coil system assures high efficiency of transmission, high stability of operation, and small temperature rise and radiation noise.