

01-05-009-02

Artificial Myocardium Assisted with Sharp Shape Memory Alloy Peltier Elements

Prof. Shigenao Maruyama of the Institute of Fluid Sciences, Tohoku University, Prof. Shinichi Nitta and Assoc. Prof. Tomoyuki Yambe of the Institute of Development, Aging and Cancer, Tohoku University, and Tokin Corp., have jointly developed a mechanism to assist the motions of an artificial myocardium using a shape memory alloy. Rod-shaped artificial muscles made of a shape memory alloy are aligned on the outside of the heart to assist the heartbeat. The electric power serving as the source of motive power is supplied by electromagnetic induction via a coil implanted in the abdomen. In animal experiments using goats, the system performance was under evaluation. The system has a simple construction and can be commercialized as an inexpensive practical system.

By using an element displaying the Peltier effect of causing heat generation and heat absorption when two types of semiconductors are connected and an electric current passed through them, and by sandwiching this element with a bar-form shape memory alloy plate, an artificial myocardium was fabricated with a length of 5cm, width of 1cm and thickness of 0.5cm. The artificial myocardium was made of nickel-titanium shape memory alloy, and displayed the characteristics of being bent or returned to its original state in conformance with the Peltier element heat generation and heat absorption. This force was utilized to assist the motions of the cardiac muscles from the outside. The electric current driving the Peltier element was supplied by electromagnetic induction with a thin disc-shaped coil from outside the body. The coil was implanted under the skin of the abdomen, and a magnetic field generated with a separate system fitted outside the body to induce an electric current in the coil and to supply the Peltier element. The coil had a diameter of less than 10cm.

Experiments were conducted by using and working an artificial heart developed for use as a goat heart, and assistance of



heart pulsation was fully confirmed. In these experiments, a power supply coil was implanted in the goat body and power supplied through an electric wire, to verify the performance of the entire system, and it was fully confirmed that the artificial heart system is applicable to healing a wide range of cardiac diseases without causing myocardial infarction.

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01-05-009-03

Portable Type Liquid Infusion Pump

Terumo Corp. has developed a portable type infusion pump Cafty Pump that is usable safely and with ease by patients undergoing liquid transfusion treatments at home. The pump is marketed at a domestic price of ¥250,000. The infusion pump is employed for the transfusion of liquids containing prescribed volumes of medical agents at a preset rate to patients. When engaging in infusion at home after a patient leaves a hospital, it will be necessary for the patient or family to work the pumps and its ancillary equipment, so it will be imperative to develop products which are operable safely and with ease.

The infusion pump developed by the company is designed for maximum safety and ease of use by patients. For example, it has a liquid crystal display that is easy to see, and pushbutton manipulations have been minimized, or it is designed for easy use not only by senior persons but as well by persons in

general. It is a cassette system that enables the pump to be operated accurately and with ease by patients, so alleviates the problems that occur during transfusion. In addition, the problem occurs during transfusion, the situation is relieved with an alarm sound by simple commands. For example, you can say "The transfusion line is so replace it", or "The pump is to fail, so replace the battery" after installing the new battery. After the transfusion set, the necessary operations are completed simply by pressing the START switch. The number of pushbuttons to be manipulated has been minimized to prevent errors.

The pump weighs 320g, which is one-third that of the conventional counterpart products. The pump is in a special-purpose case and is designed to be carried easily and smoothly and with ease by patients, which frees patients from the burden. The pump is worked by one of two units of power (used continuously around the clock) and is a purpose rechargeable battery (new) or with a pair of dry cells, which is convenient.

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