Speci-Ceps System II Heated Forceps

PRODUCT DESCRIPTION

Speci-Ceps are electrically heated forceps designed to assist in the preparation of histological or histo-pathological slides.

Orientation of a specimen during wax embedding has traditionally been completed using stainless steel forceps. To prevent their cold tips from solidifying the liquid wax medium, it is necessary to repeatedly remove the forceps from the work and heat them by external means - in a flame or embedding centre.

nsuf•cient heating results in sticking, while excessive temperatures will damage the specimen. Considerable time and skill are required to utilise this technique successfully.

Speci-Ceps System II incorporate safe, low-voltage, energy controlled heating elements which constantly maintain their tips at the optimum temperature for manipulation of specimens in histological wax. They may be used continuously, without adjustment, and without significantly infuencing the temperature of the medium or tissue.

Eliminating the task of keeping the forceps at a usable temperature enables the operator to concentrate on orientation of the tissue, and results in a significant increase in productivity.

CONSTRUCTION

A complete Speci-Ceps System II is comprised of three items:

Power Supply

This is housed in a power plug for insertion into a suitable single phase ac wall or bench outlet. The isolated, low-voltage, output of the Power Supply is routed through a permanently attached cable to a co-axial power connector.

Interface Unit

The Interface Unit connects between the Power Supply and the forceps. It is housed in a free standing flame retardant plastic case with a co-axial connector for the Power Supply lead on the rear, and miniature jack sockets at the front for connection to the two pairs of forceps.

The front panel also features three indicator lights - a red indicator to show that power is connected and a bi-coloured indicator to show the heat status for each of the pairs of forceps. This indicator flashes red when the forceps are heating up and changes to green when the forceps are at operating temperature.

Heated Forceps

The forceps are of conventional stainless steel construction with an offset form to enable fine control of closure, and to provide clearance around the twin heating elements. These are encapsulated in black epoxy resin approximately 20 millimetres from the tips. The remainder of the blades are encased in polyolefin plastic, which affords thermal insulation and a reliable finger grip for the user. Electric current is fed to the heaters via a one metre lightweight cable, terminated in a miniature jack plug for connection to the Interface Unit.

The forceps are manufactured in several different tip sizes to accommodate user preference and the type of specimen to be handled. Each size of forceps is distinguished by the colour of its plastic covering.

OPERATING PRINCIPLES

The prime requirement for the forceps is that their tips transfer minimum heat energy to or from the specimen and its surrounding liquid wax.

A closed-loop control system with sensors detecting the temperature of the specimen and adjusting the electrical power to heaters at the tips of the forceps is impractical. Such an arrangement would be physically fragile and expensive. It would require sophisticated control algorithms to avoid temperature lag and overshoot, and would not be inherently fail-safe.

The required characteristics are achieved in the Speci-Ceps System II by utilising tips of low thermal capacity, and heating them from a fixed temperature source via a path of high thermal resistance.

The constant source temperature is achieved without any external control system by employing ceramic heating elements fabricated from a compound of barium, lead, and strontium titanates. This material exhibits a rapid increase in electrical resistance when its temperature rises above a critical value. The electrical power demand of the heaters will thus change automatically to maintain this temperature as more or less heat is drawn from the forceps.

Control using this "smart material" is smooth, without any lag or overshoot. More importantly, the system is inherently fail-safe.

The operating temperature of the heaters is designed to be greater than the required tip temperature to compensate for the drop occurring across the intervening thermal resistance of the blades.
When horizontal in free air, the tips will normally stabilise between 65° and 75°C. This is slightly above the melting point of histological Waxes. If the forceps are applied to a specimen as its mounting medium solidifies, the tips will rapidly assume the temperature of the wax, and a small quantity of heat will always flow from them, retarding the setting process, and preventing them from sticking.

To provide an indication of the temperature of the forceps, a "heating" indicator light is incorporated in the Interface Unit. This is connected to an internal circuit which monitors the electrical power drawn by the heaters.

When first switched on at room temperature the forceps will initially consume approximately 11 watts, and the indicator will flash red.

From 1 to 4 minutes, depending on type, the heaters will reach their control temperature, the power demand will fall, and the indicator will stop flashing and become green.

When the tips of the forceps are applied to a cold surface the power demand will increase and the heating indicator will again flash red until the control temperature is achieved.