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MICROTOME SPECIMEN HOLDER

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Fig. 1.

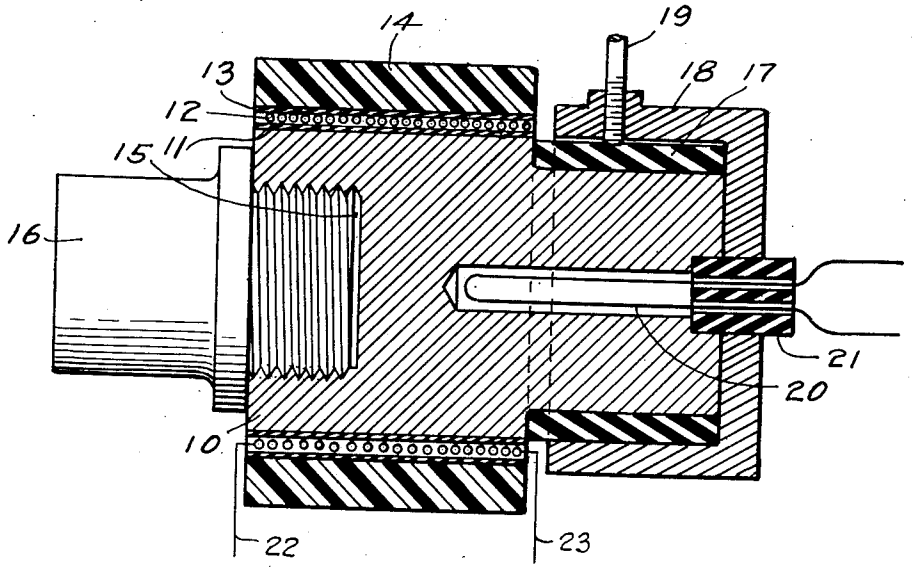
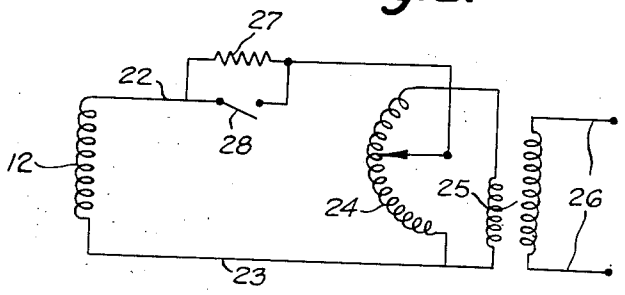


Fig. 2.



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MICROTOME SPECIMEN HOLDER

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5 Claims. (Cl. 88—40)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the Act of April 30, 1928 (Ch. 460, 45 Stat. L. 467).

This invention relates to a microtome specimen holder and more particularly relates to a microtome holder which is capable of being advanced at a constant rate.

Electron microscropy of tissue sections and the like is successful only when the sections are of the order of 0.1 micron thick. It should be possible to study the three dimensional structure of tissue by preparing a series of sections of a given tissue, each section having a known and uniform thickness. Preparing such a series requires a microtome advancing mechanism that will satisfy rigorous conditions of constancy and reproducibility. It has been proposed to precool a specimen holder with carbon dioxide and to slice sections of tissue from the sample as the block warms to room temperature, the operator guessing at the time interval required to reproduce then a suitable thermal extension of the rod or block. Such a system is not considered generally satisfactory.

Accordingly, an object of this invention is to provide a microtome specimen holder which has a uniform rate of expansion to enable slices of tissue to be taken at known intervals of time to obtain uniform widths of the slices.

Another object of the invention is to provide a microtome specimen holder wherein the rate of expansion is reproducible.

An additional object of the invention is to provide a specimen holder for a thin slicing microtome where the specimen holder rod may be uniformly advanced to the position of the cutting knife, thereby permitting a series slices of the specimen to be cut, each slice of the order of 0.1 micron in thickness.

These objects are accomplished by this invention by utilizing a metallic rod which is wound with resistance wire insulated from the block and from the atmosphere and passing a current through the resistance wire which serves as a heating coil to cause advancement of the block due to thermal expansion of the metal. These objects will become apparent from a consideration of the accompanying drawing where

Figure 1 is a cross section of the microtome specimen holder.

Figure 2 is a circuit diagram including the heating coil of the microtome specimen holder.

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As shown in the drawing, the microtome specimen holder includes a block of metal 10. The block is formed of any metal which has a known, definite linear coefficient of expansion. A definite length of linear expansion will be required to obtain a sequence of slices. A length of expansion of the order of three or four microns is satisfactory and, in fact, preferred. It is obvious that the length of the block will depend upon the particular metal used to obtain this length of expansion since the length of expansion is a function of the coefficient of expansion, the change in temperature and the length of the block.

A sleeve 11 of insulating material surrounds the block. Any electrical insulating material is suitable as long as there is no electrical contact between the block and the hereinafter described resistance wires. Mica is preferred as the insulating material for this sleeve.

Coiled around the block and insulated therefrom by the mica sleeve 11 is a length of high resistance wire 12. In this configuration the wire forms in effect a heating coil. The wire is suitably connected to a source of electrical current which current may be varied in order to control the temperature of the wire, and hence of the block, to any desired degree as will be more particularly described hereinafter.

Superimposed upon the wire coil 12 is a second sleeve of insulating material 13 with the same characteristics as insulating sleeve 11 and again preferably formed of mica.

A sleeve 14 of thermal insulating material is superimposed on sleeve 13. This thermal insulating sleeve, as the term implies, is used in order to concentrate the heat generated in the resistance coil 12 into the block 10 rather than to allow this heat to be dissipated into the atmosphere.

A socket 15 is provided in one end of the block in order to allow for the mounting of the specimen block 16. Specimens to be held for cutting in the microtome are normally mounted in a block of plastic or the like. As shown in Figure 1, the mounting socket 15 is provided with threads as is the plastic block 16 which holds the specimen. It is obvious that any suitable holding means used other than threads may be utilized as long as the specimen is rigidly and immovably mounted in the socket.

At the other end of the block, a collar 17 of suitable insulating material is provided. As is obvious from a consideration of the drawing, this collar insulates the block 10 from the jaws 18

of the microtome so that heat from the block is not dissipated to these jaws. As shown in the figure, set screw 19 in the jaws of the microtome will also be insulated from the block by collar 17.

In order to read the temperature of the block 10, particularly for device testing purposes, a thermo-couple 20 is mounted in the block. Any suitable means such as insulating collet 21 is used to provide an exit for the thermo-couple from the device.

As hereinbefore described, the resistance coil 12 is suitably connected to a source of electrical current as through leads 22 and 23, and switch 28 (normally closed), to a variable auto transformer 24 connected to step-down transformer 25, in turn connected to the line terminals 26. A voltage is applied in order to obtain a constant heating of the block 10 due to the resistance of the wire coil 12. It will be appreciated that a substantially constant applied voltage will cause a constant heating of the block 10 and the desired slices may be taken at the desired intervals of time. In order to enable the operator to stop the expansion for a short time, if need arises, and then continue with the same cutting schedule, an additional resistor 27 may be connected to the circuit. In such cases the operator may throw the switch thereby placing the resistor in series in the circuit and hence preventing further heating of the block 10. It may be seen that such a circuit will also prevent the block from cooling and hence contracting.

One particular embodiment of the invention consists of a block 10 made of brass with dimensions of 2 inches in length and $1\frac{3}{16}$ inches in diameter. The block is wound with 20 feet of resistance wire having a resistance of 78.1 ohms. The thus formed wire coil is electrically insulated from the block by a thin sheet of mica 11. The outer surface of the wire is thermally insulated by a cylinder of methacrylate $1\frac{3}{4}$ inches long and $\frac{1}{4}$ inch thick. The block is insulated from the jaws 18 of the microtome by a phenol-formaldehyde collar 17 which is $\frac{1}{8}$ inch thick. The power line available is connected to a transformer and a voltage output of 10 volts is utilized. With this holder and a resistance coil of 78 ohms, an applied voltage of 10 volts gives an expansion of the holder amounting to three microns in six minutes.

It will be appreciated from a reading of the foregoing specification that the invention herein described is susceptible of various changes and modifications without departing from the spirit and scope thereof. The invention is, therefore, to be limited only by the scope and spirit as set forth in the appended claims.

What is claimed is:

1. A microtome specimen holder comprising a metallic block, a sleeve of insulating material around a portion of said block, a coil of resistance wire surrounding said sleeve, a socket for mounting a specimen in one end of said block, a collar of insulating material at the other end of said block to insulate said block from the supporting jaws of the microtome and means for passing a current through said coil of resistance wire.

2. A microtome specimen holder comprising a metallic block, a sleeve of insulating material around a portion of said block, a coil of resistance wire surrounding said sleeve, a second sleeve of insulating material superimposed on said coil, a socket for mounting a specimen in one end of said block, a collar of insulating material at the other end of said block, said collar serving to insulate said block from the supporting jaws of the microtome and means for passing a current through said coil of resistance wire.

3. A microtome specimen holder comprising a metallic block, a sleeve of electrical insulating material around a portion of said block, a coil of resistance wire surrounding said sleeve, a second sleeve of electrical insulating material superimposed on said coil, a sleeve of thermal insulating material superimposed on said second sleeve of electrical insulating material, a socket for mounting a specimen in one end of said block, a collar of insulating material at the other end of said block, said collar serving to insulate said block from the supporting jaws of the microtome, and means for passing a current through said coil of resistance wire.

4. A microtome specimen holder comprising a metallic block, a sleeve of mica around a portion of said block, a coil of resistance wire surrounding said sleeve, a second sleeve of mica superimposed on said coil, a sleeve of thermal insulating material superimposed on said second mica sleeve, a socket for mounting a specimen in one end of said block, a collar of insulating material at the other end of said block, said collar serving to insulate said block from said supporting jaws of the microtome, means for passing a current through said coil of resistance wire, and means for varying the amount of current through said wire to thereby control the temperature of said block.

5. A microtome specimen holder comprising a metallic block, a sleeve of insulating material around a portion of said block, a coil of resistance wire surrounding said sleeve for heating said block, a socket for mounting a specimen in one end of said block, a collar of insulating material at the other end of said block to insulate said block from the supporting jaws of the microtome, circuit means connecting said heating coil to a source of electrical energy, means in said circuit to adjust the input to said coil to thereby cause said coil to heat and the temperature of said block to rise at a substantially constant rate, resistance means adapted to be connected in series in said circuit to thereby decrease the current to said heating coil and to thereby maintain the block at a substantially constant temperature, and means for placing said resistance in said series circuit and for removing it therefrom, thereby enabling the temperature increase of said block to be periodically interrupted without cooling said block.

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