

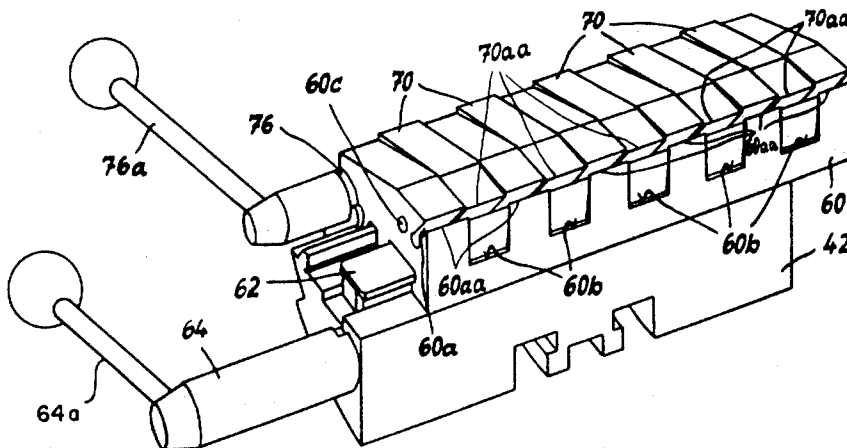
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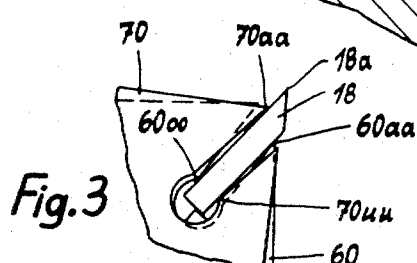
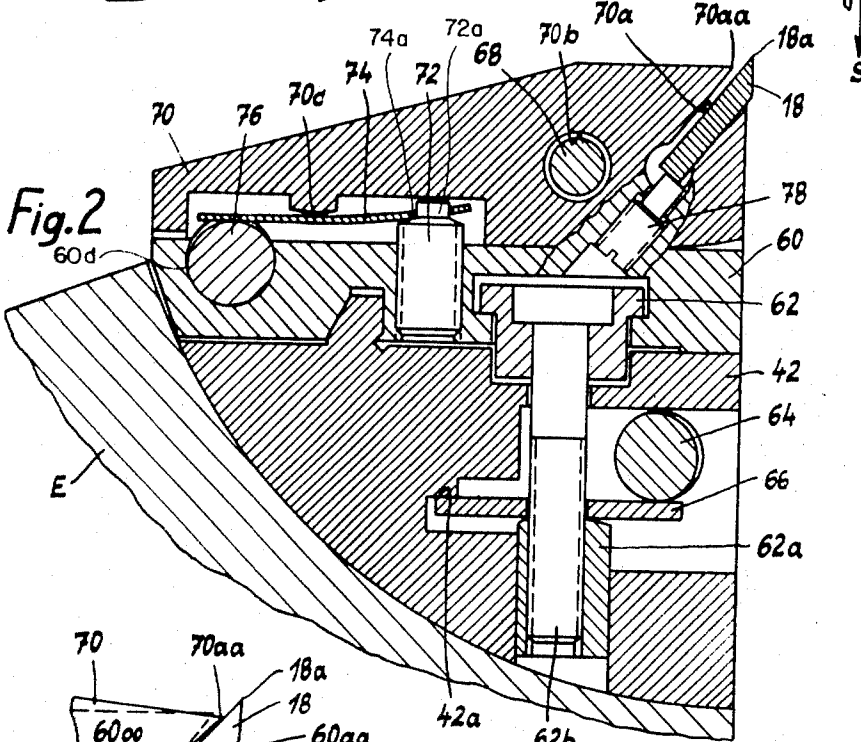
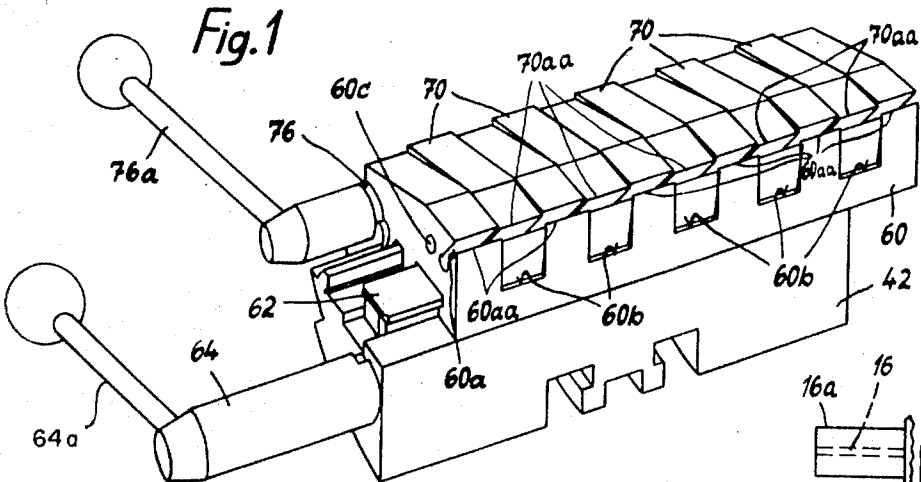
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[54] **CLAMPING DEVICE FOR MICROTOME KNIVES**  
**9 Claims, 3 Drawing Figs.**

[52] U.S. Cl..... 83/699,  
 83/915.5  
 [51] Int. Cl..... B26d,4/48  
 [50] Field of Search..... 83/915.5,  
 698, 699, 700

**ABSTRACT:** A clamping device for a microtome knife comprises a holder which includes a support surface having a clamping edge which bears against a lower longitudinal surface of the knife. A plurality of adjustable clamping elements are serially positioned in longitudinally spaced recesses in the holder and are adjustable through rotation of a self-locking eccentric rod. Actuation of the eccentric rod causes a clamping edge on each of the clamping elements to engage an upper longitudinal surface of the knife and to press the knife against the clamping edge of the holder in a closed system of forces.





## CLAMPING DEVICE FOR MICROTOME KNIVES

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates to a clamping device for microtome knives, and more particularly for a microtome knife used in cutting hard preparations.

## 2. The Prior Art

Most known forms of clamping devices for microtome knives provide gripping of the knife by a closed system of forces and specifically by a number of opposed clamping jaws which engage a portion of the knife and which are adapted to be adjusted by tightening of a screw or similar means. Constructions of this type suffer a number of disadvantages. First, a frequent occurrence is that all of the clamping jaws are not fully tightened because the user, who, for example, may be a medical assistant, does not, either from neglect or lack of facility, effect the exertion of the necessary tightening force. Further, with constructions of this type the knife may not be uniformly fully supported in the holder, in that complete support is often provided only in the areas where the clamping jaws engage the knife because of tolerance differences. It is noted that particularly where a knife of considerable longitudinal extent is to be supported, the support provided by such prior constructions is generally uneven in that portions of the knife may be lifted from contact with the support by stresses and strains on the knife in other areas. Where there is non-uniform clamping support of the knife accurate positioning of the cutting edge of the knife cannot be obtained. Further, in some instances the knife may wobble in the holder particularly under circumstances where hard preparations are being cut. Accurate positioning is of course essential for microtome knives in that without such positioning the very thin preparation shavings cannot be cut with the requisite constant accuracy.

## SUMMARY OF THE INVENTION

In accordance with the present invention a clamping device is provided which effects uniform clamping of a microtome knife in the knife holder independent of the force exerted by the user and of the length of the knife. The clamping device provides effective mounting of the knife over the entire length thereof and support for the knife directly beneath the cutting edge.

In accordance with a presently preferred embodiment of the invention the clamping device comprises a holder containing a support surface which includes a clamping edge for bearing against a first longitudinal surface of a microtome knife. A plurality of adjustable clamping elements positioned adjacent to the holder each include a projection for engaging a second longitudinal surface of the knife opposite to the first longitudinal surface and for pressing the knife against the clamping edge of the holder in a closed system of forces. The clamping elements are adjusted by means of an eccentric element cooperating with a leaf spring. The eccentric element preferably comprises a single eccentrically mounted rod which adjusts all of the clamping elements and which is mounted in a part-cylindrical recess in the holder. The rod is rotatable in the recess and is dimensioned with respect thereto such that a predetermined amount of rotation of the rod causes locking of the rod in the recess. A leaf spring is provided for each of the clamping elements, the springs including an opening at one end thereof for seating the springs on the holder. A projection mounted on each clamping element bears against the associated leaf spring at a point approximately midway along the length thereof while the other ends of the springs bear against and are supported by the eccentric rod.

The holder itself preferably includes a series of spaced recesses for receiving the adjustable clamping elements, the holder and clamping element being arranged in a manner similar to the arrangement of piano keys. A rod extending longitudinally through a series of aligned apertures in the clamping elements and in the holder serves to retain the clamping

elements in position. In accordance with a presently preferred embodiment the holder includes a slot open at one end for receiving the knife, the slot being of a width slightly exceeding the thickness of the knife and the lower edge of the slot constituting the clamping edge described hereinabove. Similarly, the clamping elements each include a slot open at one end for receiving the knife and of a width slightly exceeding the thickness of the knife. The upper edge of each slot of the clamping elements constitutes the projection for engaging the second surface of the knife as described above. With this arrangement a knife may be seated between the clamping edge of the holder and the upper edge of the clamping element as described with additional seating of the knife being provided by a second edge on the holder and a second edge on each clamping element. Set screws may advantageously be employed to aid in positioning of the knife in the holder.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present invention will become apparent upon consideration of the following description of the invention taken with the accompanying drawings wherein:

FIG. 1 is a perspective view of a presently preferred embodiment of the clamping device of the present invention; FIG. 2 is an enlarged cross sectional view of the clamping device of FIG. 1; and FIG. 3 is a detail view of a portion of FIG. 2.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing the clamping device according to the invention comprises a main body portion 42 which is mounted in a setting device generally denoted E in FIG. 2. The main body portion 42 may be mounted so that it may be rotated by guide elements (not shown) about three axes, these axes being disposed at right angles with respect to one another and preferably intersecting at a point. The setting apparatus E may also include a number of locking elements (not shown) employed to maintain the body portion 42 in a set position. An example of such a setting apparatus is described in U.S. Pat. No. 3,308,704 which is assigned to the assignee of the present invention.

The clamping device further comprises a knife holder 60 which is guidedly mounted in the main body portion 42 so as to permit longitudinal movement thereof in a horizontal plane. Holder 60 may be locked in a set position by means of adjustable clamping studs 62 (one of which is shown in each of FIGS. 1 and 2). Adjustment of the clamping studs 62 is affected by tightening or loosening of an eccentric rod 64. Rod 64 acts, through a leaf spring 66, on a clamping block 62a threadably received on a lower threaded bolt portion 62b of clamping stud 62. One end of leaf spring 66 is supported on the main body portion 42 at a point 42a while the other end of leaf spring 66 bears against the peripheral surface of rod 64. One end of rod 64 projects outwardly of body portion 42 and is fitted with a handle 64a. It will be appreciated that rotation of rod 64 through actuating handle 64a will produce axial movement of clamping stud 62 via the force transmitted through leaf spring 66 to clamping block portion 62a.

Knife holder 60 includes an oblique accommodating slot 60a for receiving a microtome knife 18. The width of slot 60a is only slightly greater than the thickness of knife 18. Holder 60 further includes a number of transverse recesses 60b adapted to receive a corresponding number of clamping elements 70 described hereinbelow. A series of aligned holes 60c provided in the non-recessed portions of holder 60 cooperate with a rod member 68 to prevent the clamping element 70 from separating from the holder. Rod 68 is loosely fitted through the holes 60c and thus permits some limited movement of the clamping elements. A clamping element 70 is positioned in each recess 60b and each element includes a hole 70b, corresponding to holes 60c, adapted to receive rod 68.

Clamping elements 70 also include an accommodating slot 70a similar to slot 60a of holder 60. Slots 70a are of a width only slightly greater than the thickness of microtome knife 18 and with clamping elements 70 positioned in recesses 60b the slots 70a are arranged obliquely in a manner similar to slots 60a. Adjustment of clamping elements 70 is effected through means of an adjusting device which includes a threaded gudgeon 72 received in the body of holder 60. A leaf spring 74 is affixed at one end to gudgeon 72 by means of an opening 74a through which a pin member 72a of the gudgeon 72 projects. The opposite end of leaf spring 74 is freely supported on a cam member 76 which extends parallel to accommodating slot 60a. Cam member 76 is formed as an elongate rod and includes an outer portion which projects outwardly of holder 60 and is fitted with an actuating handle 76a. Rod member 76 is eccentrically mounted in a longitudinal, part-cylindrical recess in the body of holder 60. Rod 76 is generally rotatable in recess 60d but rod 76 and recess 60d are so dimensioned that a predetermined amount of rotation of rod 76 will cause locking thereof in recess 60d. Clamping elements 70 include a projection 70c which bears against leaf spring 74 at a point approximately midway along the length thereof. It will be appreciated that rotation of eccentric rod 76 will cause leaf spring 74 to bear against projection 70c of clamping element 70 and thus cause pivoting or rocking of clamping element 70. This pivoting of clamping element 70 will cause a projection 70aa, described hereinbelow, to bear against the surface of microtome knife 18.

A number of set screws 78 which project into a lower circular portion of accommodating slot 60a serve as a rest or stop for the knife 18. Set screws 78 are threadably received in an inclined bore in holder 60 and may be adjusted to aid in positioning of knife 18.

In mounting knife 18, the knife is first placed loosely in the accommodating slots 60a and 70a with the lower end thereof bearing against the face of set screws 78 and the lower longitudinal surface thereof resting against the lower surfaces of slots 60a and 70a. Actuation of handle 70a causes rotation of eccentric rod 76 and consequent rocking of each of the clamping elements 70 caused by the force exerted by the individual leaf springs 74. Rocking of the clamping elements 70 causes the upper edge or projection 70aa of each clamping element 70 to force knife 18 against the front clamping edge 60aa of the accommodating slot 60a. Further, the lower edge 70uu (FIG. 3) of each clamping element 70 causes slight lifting of the rear portion of knife 18 such that the upper longitudinal surface of knife 18 bears against the upper edge 60oo of the accommodating slot 68. Thus, as can best be seen in FIG. 3, the knife 18 is held firmly between edges 60aa and 70aa and edges 60oo and 70uu. Knife 18 will be held with a predetermined uniform clamping force under the control of the self-locking eccentric rod 76. The serial arrangement of clamping elements 70 in recesses 60b provides uniform pressure on knife 18 along the entire length thereof. The single control provided by eccentric rod 76 eliminates any play between the clamping device and the knife and assures firm clamping action.

The blade 18a of knife 18 is disposed, with knife 18 clamped as shown in FIG. 3, directly above the clamping edge 60aa of holder 60 such that full cutting pressure may be absorbed without any distortion. With the arrangement of the invention, slices of a constant uniform thickness may be cut from preparation 16 even where very small thicknesses are desired. Preparation 16 is embedded in a sleeve 16a and the preparation 16 is moved in a direction S to effect cutting.

It will be appreciated that the clearance between knife 18 and the width of the accommodating slot 60a and 70a is exaggerated in FIGS. 2 and 3 for illustrative purposes. As noted

above, in actual practice, this clearance amounts, at the most, to only a few tenths of a millimeter.

It will be understood by those skilled in the art that the embodiment shown and described hereinbefore is subject to modification without departing from the scope and spirit of the invention. Thus the invention is not to be taken as being limited by the exemplary embodiments but rather to be defined by the subjoined claims.

We claim:

1. A clamping device for a microtome knife having first and second opposed longitudinal surfaces, said clamping device comprising holder means including a support surface, said support surface including a clamping edge for bearing against a first longitudinal surface of a microtome knife; a plurality of adjustable clamping elements positioned adjacent said holder means, each of said adjustable clamping elements including a projection for engaging a second longitudinal surface of the knife opposite to the first longitudinal surface and for pressing the knife against said clamping edge of said holder means in a closed system of forces and a common adjusting member for adjusting said plurality of adjustable clamping elements.

2. A clamping device as claimed in claim 1 further comprising a leaf spring associated with each of said adjustable clamping elements and eccentric means located on said common adjusting member for engaging each said leaf spring to adjust the associated clamping element.

3. A clamping device as claimed in claim 2 wherein each of said leaf springs including an opening at one end thereof; said holder means includes pins for seating individual of said leaf spring openings; and each of said clamping elements includes a projection for bearing against an individual leaf spring at a point approximately midway along the length thereof, each of said leaf springs, at the other end thereof, bearing against and being supported by said eccentric means.

4. A clamping device as claimed in claim 2 wherein said common actuating member comprises a single eccentrically mounted rod for simultaneously adjusting each of said plurality of clamping elements.

5. A clamping device as claimed in claim 4 wherein said holder means includes a part-cylindrical recess for mounting said eccentric rod, said rod being rotatable in said recess and being dimensioned with respect to said recess such that a predetermined amount of rotation of said rod effects locking of said rod in said recess.

6. A clamping device as claimed in claim 5 wherein said rod includes a handle located on an end portion of said rod which projects outwardly of said holder means.

7. A clamping device as claimed in claim 1 wherein said holder means includes a series of longitudinally spaced recesses located therein and wherein each of said clamping elements is individually positioned in one of said recesses, and wherein said device further includes a rod member extending through a plurality of aligned apertures formed in said holder means and in said clamping elements for retaining said clamping elements in said recesses.

8. A clamping device as claimed in claim 1 wherein said holder means includes a slot open at one end for receiving a knife, said slot being of a width slightly exceeding the thickness of the knife and a lower edge of said slot constituting said clamping edge; and said clamping elements each include a slot open at one end for receiving the knife, said last-named slot being of a width slightly exceeding the thickness of the knife and an upper edge of said slot constituting said projection for engaging a second surface of the knife.

9. A clamping device as claimed in claim 7 wherein said holder means includes at least one adjustable stop for cooperating with said clamping edge to position the knife.