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[56] **References Cited**

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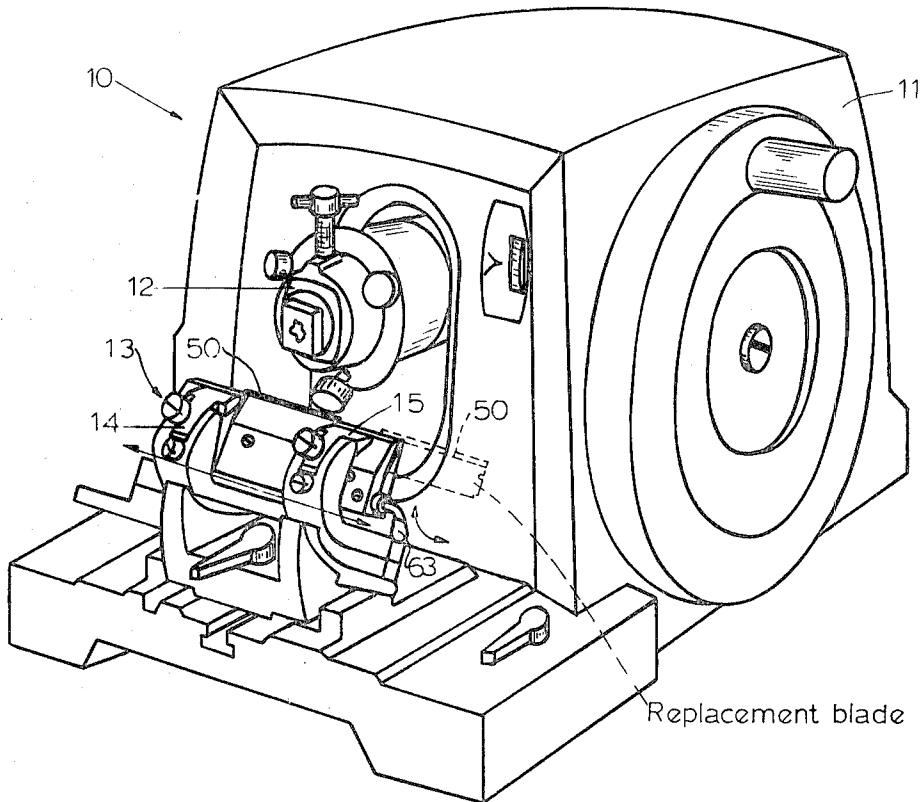
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Primary Examiner—William S. Lawson
 Attorney—B. B. Olive

[54] **DISPOSABLE BLADE AND HOLDER FOR
 MICROTOME**
 7 Claims, 15 Drawing Figs.

[52] U.S. Cl. 83/412,
 83/651, 83/698, 83/915.5
 [51] Int. Cl. G01n 1/06
 [50] Field of Search 83/412,
 414, 651, 662, 698, 915.5

ABSTRACT: The conventional, thick, microtome knife that is resharpened after use is replaced by a thin, flexible, disposable and commercially available blade which has a microtome quality cutting edge and which is held by a blade holder that in turn is received by a conventional knife clamp. The blade holder is adapted to flex, clamp and tension the disposable blade and includes an adjustable cam mechanism which allows the technician to replace blades without disturbing the holder.



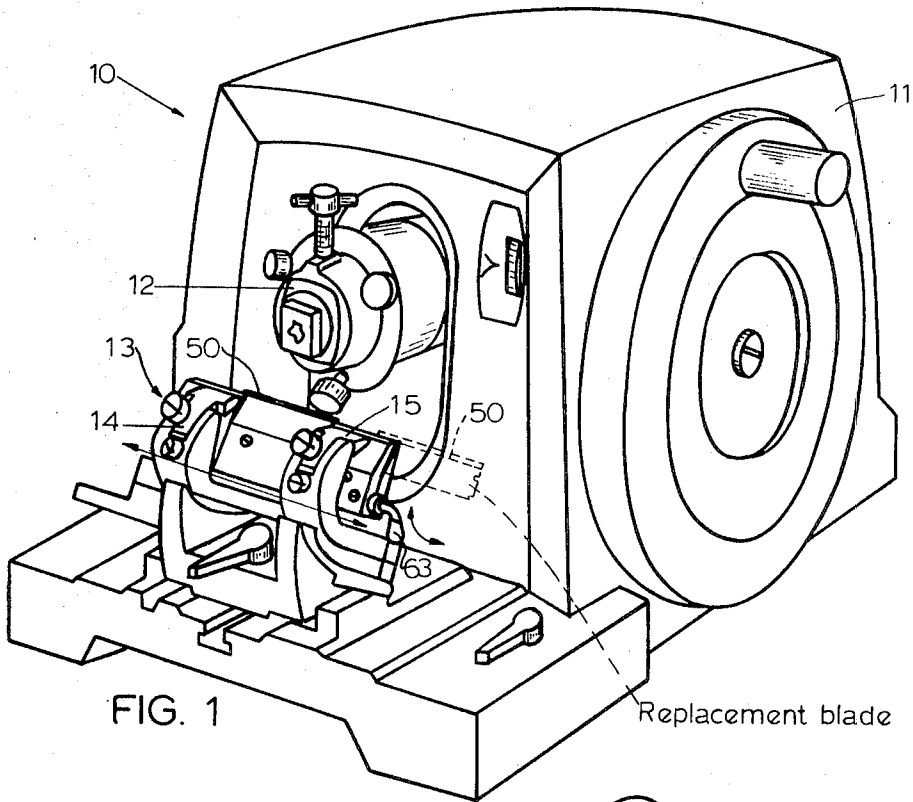


FIG. 1

Replacement blade

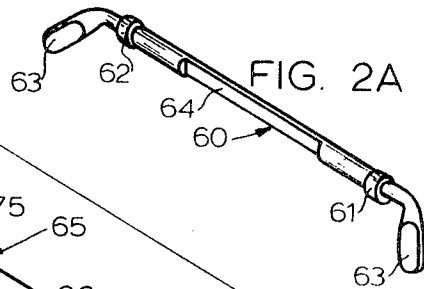


FIG. 2A

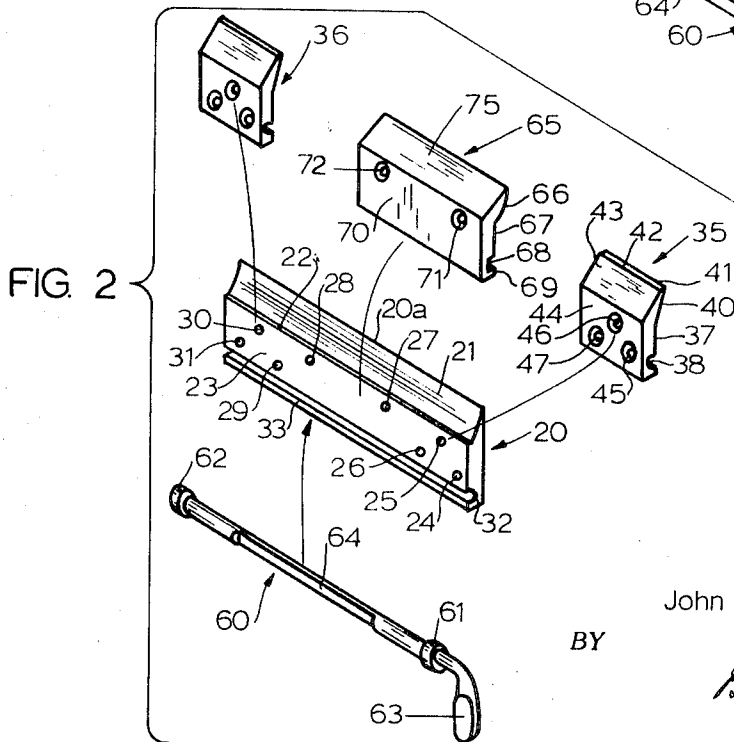


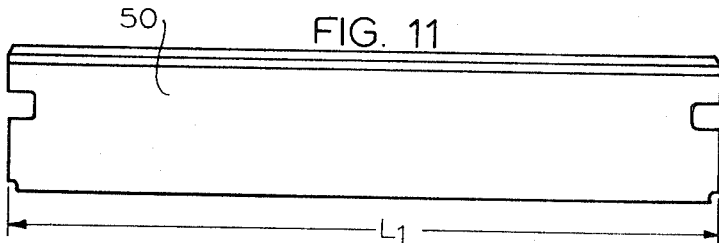
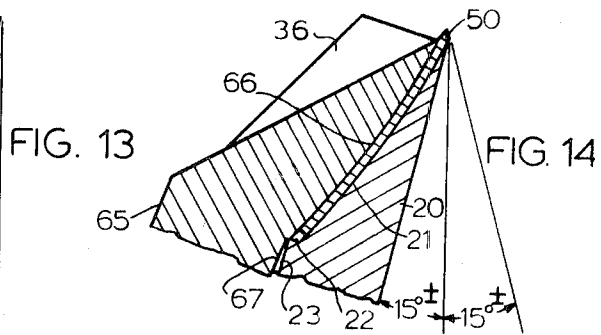
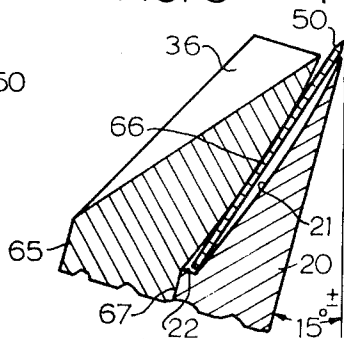
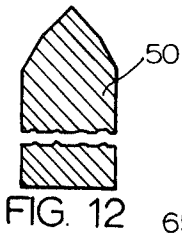
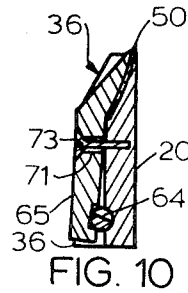
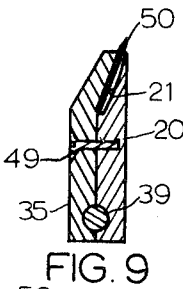
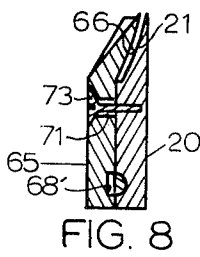
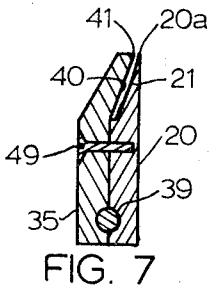
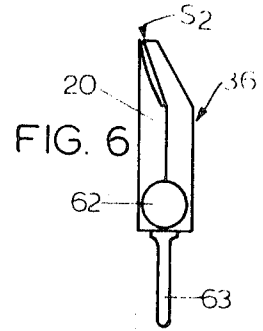
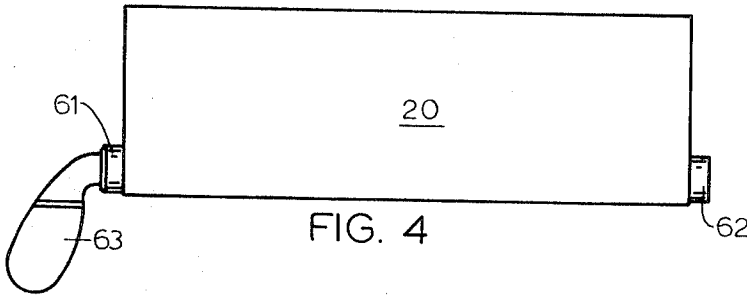
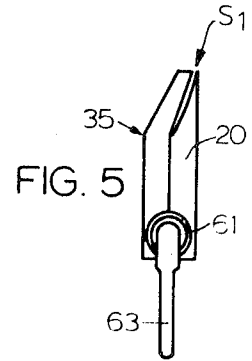
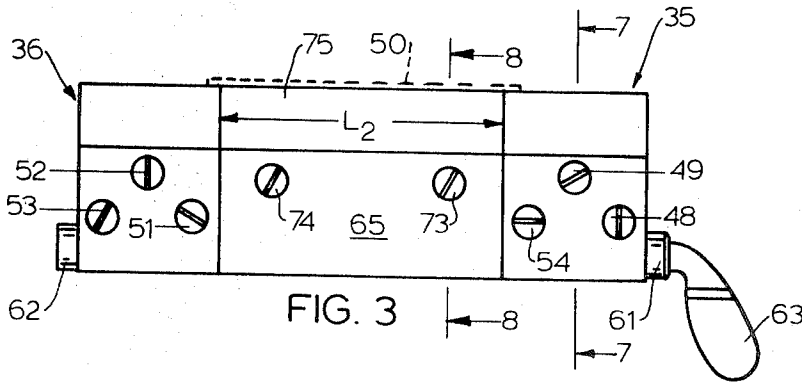
FIG. 2

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DISPOSABLE BLADE AND HOLDER FOR MICROTOME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to microtome knives or blades and knife or blade holders and particularly to disposable blade and disposable holders constructions.

2. Description of the Prior Art

It has long been the practice in the art for microtome knives to take the form of being relatively thick, inflexible, and adapted to being resharpened. Such knives are made of a very fine grade of steel and are adapted to receive an extremely sharp and relatively smooth cutting edge when sharpened. Such knives as seen in profile are biconcave, planoconcave, wedge shaped or tool edge shape sharpened. However, the conventional knives are expensive in initial cost and require expensive and time consuming resharpening equipment as well as extra technician time for resharpening. Also, such knives are susceptible to corrosion.

To illustrate how long established the practice has been, reference is made to U.S. Pat. No. 1,026,280 issued May 14, 1912 and which shows one type microtome knife that is in widespread use today. Over the years there have been many attempts to provide a microtome blade holder adapted to receive some type of disposable blade such as "wafer" type double edge blades or typical single edge safety razor blades and representative prior patents are found in U.S. Pat. No. 1,865,539 No. 1,998,428; No. 2,232,008 and No. 3,227,020. Some of the prior patent blade holders and disposable blades have found limited application in teaching laboratories where the cutting requirements are not critical and where relatively soft tissue is being cut. However, there has never appeared a practical, disposable blade system based on a quick change blade holder adapted to the conventional microtome and knife clamp and adapted to use of a disposable blade having a microtome knife quality cutting edge capable of cutting not only the soft teaching tissue but also a wide range of bone, dense hard tissue and the like in relatively wide widths of specimens. Furthermore, essentially all of the prior art blade holders that have reached the trade have been adapted to use the conventional very thin, "wafer" type blade or the single edge safety razor type which inherently exhibit a relatively rough cutting edge as compared to a microtome knife quality cutting edge.

In addition to the conventional thin, disposable "wafer" type double edge and single edge safety razor blades sold under such trademarks as Gillette, Wilkinson, Star, Personna and Gem another type of disposable blade used in surgical practice is the single edge, disposable surgical blade sold under various trademarks, e.g. Personna and Weck. Blades of this type are widely used for surgical preparation, autopsies and general tissue cutting. The surgical Personna or Weck type blade like the Gem and Star single edge blade is normally provided on the unsharpened edge with a bent metal cover or banding member which gives rigidity to the blade and allows the user to safely hold the blade for cutting. The surgical blade differs from the conventional double edge, "wafer" blade in that it is generally thicker, longer, and more elongated and rectangular in shape than most conventional single edge and double edge disposable wafer blades. When the mentioned cover member is removed from the surgical blade it has been found that while not as flexible as the usual wafer blade the surgical blades can nevertheless be flexed with a properly applied force. Of particular importance, the surgical blade inherently lends itself to being made with an extremely sharp and relatively smooth edge of microtome knife quality whereas ordinary conventional single and double edge disposable blades even though suited to ordinary shaving do not in fact have either relatively smooth or sharp edges. While both conventional, disposable, single edge and double edge "wafer" type blades have been used in microtome blade hol-

ders for disposable blades, the art has not heretofore taught a cutting system built around the employment of the surgical type blade, e.g. those made by Personna or Weck, modified by removal of the mentioned cover member. Accordingly, the art has not had available a disposable blade having a cutting edge of microtome knife quality.

Another aspect of cutting with both the conventional microtome knife as well as with such types of disposable blades as have been shown in prior art is that a change of blade almost always requires repositioning of the knife or blade holder before cutting is recommenced. If a blade or knife is nicked or damaged at the time of locating say a very thin and malignant tumor or lesion then if the blade is moved for replacement the chances are high that the tumor or lesion will be missed. This is so since the knife or blade after being unclamped and being replaced may cause up to five succeeding sections to be missed in the course of getting the cutting thickness readjusted. Of equal significance is that many times when very thin sections, e.g. 1 to 2 microns, are being cut, the operator may have to try a number of supposedly sharp knives to find an acceptable cutting edge. The problem of knife damage and required resharpening, if not complete discard of the damaged knife, also arises whenever a hard cotton or nylon suture, surgical clip, gun pellet, calcium deposit or like foreign matter is embedded in the tissue being cut and strikes the knife edge. Using the teaching of U.S. Pat. No. 1,865,539 as an example, it will be observed in another aspect of the prior art that prior art disposable wafer blade holders require loading of new wafers from the front of the holder. Since the front of the holder is in the immediate cutting area where the tissue ribbons collect each blade change inherently requires disturbing this critical operational area and introduces the possibility of foreign matter, e.g. paraffin, getting into the blade holder interior. Furthermore, such front loading holder blade change mechanisms are generally awkward and slow to operate and do not adapt to the requirements for holding blades being used to cut frozen tissue, e.g. a Cryostat microtome. A microtome blade holder for holding a disposable blade having a cutting edge of microtome knife quality, which can cut any type tissue, bone etc. cut by a microtome knife, which allows side loading replacement and which adapts to both frozen and unfrozen tissue cutting has therefore not been provided by the prior art. This is particularly made evident by the fact that no such disposable blade-holder system is in widespread use.

SUMMARY OF THE INVENTION

According to the invention there is provided a precision machined microtome blade holder adapted to releasably receive the surgical type, single edge, disposable blade having a microtome quality edge for use in cutting all of the various type of thick, thin, soft, hard and dense tissue and bone specimens encountered in medical laboratory practice. The blade holder is adapted to be received by the conventional precision microtome knife clamp, so that no modification of the conventional microtome or clamp is required. When clamped in cutting position, the surgical type blade is slightly tensioned an curved and such blade curvature adds to the normal angle tilt of the blade holder, corresponding to the usual microtome knife tilt, to facilitate a proper angle of cut and clearance of the tissue block when moving past the blade. The blade length extends slightly beyond the maximum width of tissue block used on the rotary microtome which insures getting a full width of tissue cut with the widest block. A cam mechanism moves between a blade clamping and blade release position and in the release position a replacement blade can be slid in from either side of the holder and used to eject the worn blade being replaced without disturbing the blade holder which remains clamped in position. Adjustments are provided whereby the amount of pressure applied to the blade can be regulated to thus regulate the curvature, which is preferably on about a 1174 inches radius.

The blade holder and disposable blade combination of the invention adapts to cutting thick, thin, dense and both soft and hard specimens. The operator is assured that any replacement will do the job thus eliminating the requirement to check many knives and to search for a suitably sharpened knife when cutting very thin sections. When blades are replaced the operator can immediately resume sectioning without fear of losing some critical and thin section in the course of restarting the cutting schedule. A fixed angle of cutting is immediately established as soon as the blade is installed and clamped and this angle will normally not change so long as the same type tissue is being cut. Yet, such angle can be quickly changed by rotating the microtome knife clamp. It should be noted that in comparison each change of a conventional knife requires angle adjustment since sharpening wears away at the knife edge.

From the viewpoint of costs it can be readily seen that conventional knife blade resharpening and replacement is measured in terms of dollars per knife use whereas the disposable blade system of the invention involves cost per blade use measured in terms of cents.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial view of a conventional microtome and knife clamp with the disposable blade holder of this invention mounted in the clamp, and in dashed lines old and new blades.

FIG. 2 is an exploded perspective view of the blade holder of this invention showing the main parts thereof.

FIG. 2A is an alternate cam shaft construction.

FIG. 3 is a plan view of the assembled blade holder of FIG. 2 and showing in dashed lines the position of the disposable blade held by the holder.

FIG. 4 is a rear elevation of the holder of FIG. 3.

FIG. 5 is a right end elevation of FIG. 3 in unlocked position.

FIG. 6 is a left end elevation of FIG. 3 in unlocked position.

FIG. 7 is an elevation section view taken along line 7-7 of FIG. 3 in unlocked position.

FIG. 8 is an elevation section view taken along line 8-8 of FIG. 3 in unlocked position.

FIG. 9 is a view like FIG. 7 and showing a disposable blade in unlocked position within the holder.

FIG. 10 is a view like FIG. 8 and showing the disposable blade in a locked position within the holder.

FIG. 11 is a plan view of a disposable blade used in this invention.

FIG. 12 is an enlarged, fragmentary, elevation section view of the disposable blade.

FIG. 13 is an enlarged, fragmentary, section view of the disposable blade receiving portion of the unlocked holder of FIG. 8 but shown in a normal tilt, off vertical.

FIG. 14 is an enlarged, fragmentary, section view of the disposable blade receiving portion of the locked holder of FIG. 10, but which is also shown in a normal tilt, off vertical.

DETAILED DESCRIPTION

Referring to FIG. 1, a conventional, rotary microtome 10 comprises a housing 11 having the customary gearing for moving the specimen holder 12 in a vertical reciprocatory path and at the same time feeding holder 12 outwardly against a stationary knife. The knife clamp of microtome 11 is generally indicated at 13 and is the conventional Johns Hopkins clamp for the American Optical Company, Spencer 820 microtome which is used in illustration. Knife clamp 13 is adjustable both rotatably and laterally as indicated by the arrows in FIG. 1 so that the knife can be adjusted for the proper clearance angle, tilt and position. Knife clamp 13 has a pair of jaws 14, 15 against which the end portions of the disposable blade holder of the invention are securely held in the clamp. That is, the space normally occupied by the conventional microtome knife is instead occupied by the blade holder of the invention, the invention blade width being at most a minor portion of the conventional knife width.

The blade holder in the preferred form is comprised of five parts, two of which are movable. Support for the disposable blade is provided by a backing plate 20 which resides in clamp 13 and has ends which extend outside the respective jaws 14, 15. Backing plate 20 has beginning at its uppermost edge 20a, a concave sloping surface 21 which in use receives the disposable blade and which extends downward a predetermined distance corresponding to the width of disposable blade 50, and across the complete width of plate 20. At the base of concave surface 21 is a shallow ledge 22 which acts as a stop or rest and supports the disposable blade 50 to be later described. A flat face 23 extends downward from ledge 22. Face 23 has threaded holes 24, 25, 26, 27, 28, 29, 30 and 31 which extend into plate 20 a predetermined distance. Near the bottom edge of plate 20 there is a semicircular groove 32 which extends into and cross plate 20. Immediately adjacent the bottom of plate 20 and extending upwardly to the bottom edge of groove 32 is a small flat face area 33. The back of plate 20 is formed flat which provides a flat back clamping surface for clamping the blade holder of the invention in the jaws 14, 15 of the conventional knife clamp 13.

Opening and closing of the blade holder is controlled by a rotatable cam shaft member 60 whose ends terminate in a pair of stops 61, 62 formed integral therewith and which act to prevent axial movement of shaft 60 in groove 32 of backing plate 20. When the blade holder of the invention is assembled, stops 61, 62 reside on the ends of back plate 20 as best shown in FIGS. 3 and 4. Shaft 60 has an integral extension which extends outward and downward from stop 61 and provides a finger grip or manual control member 63 for the operator to use in rotating cam shaft 60. Shaft 60 also has a flat side 64 cut therein which provides a flat side whose function will be described later.

A pair of identical clamping plates 35, 36 are adapted to be fixedly mounted on plate 20. Since plates 35 and 36 are identical, only plate 35 will be described in detail and it will be seen that plates 20, 35 and 36 form an essentially integral structure. Clamping plate 35 has a flat inner face 37 which matches flat face 23 of plate 20. Also, a semicircular groove 38 mates with groove 32 of plate 20 and together form a circular opening 39. Upward a predetermined distance from groove 38 is an inward angled flat surface 40. Surface extends upward a predetermined distance so that the uppermost edge 41 is in alignment with edge 20a of backing plate 20. At this point, edge 41 extends outward forming a flat ledge 42. Ledge 42 then extends downward at a predetermined angle a predetermined distance to form a sloped clamping face 43 which joins a flat front face 44. Face 44 has three threaded holes therein 45, 46, 47 mating respectively with threaded holes 24, 25, 26 in plate 20. Holes 45, 46, 47 are recessed so that the screw heads of screws 48, 49, 54 will remain flush with face 44. Once screws 48, 49, 54 are tightened, clamping plate 35 is held firmly in place against backing plate 20. As previously stated, clamping plate 36 is identical to clamping plate 35 and is held firmly in place by screws 51, 52, 53 mating with holes 29, 30, 31 respectively. Clamping plates 35, 36 thus hold cam shaft 60 in place but with freedom to rotate. While shown as three separate parts plates 20, 35 and 36 could of course be made as an integral unit and cam shaft 60 mounted accordingly and made with one (FIG. 2) or two finger grips (FIG. 2A).

A central pivotal plate 65 fits within the lateral spacing of clamping plates 35 and 36 and as later explained provides means for clamping blade 50. Plate 65 has a convex sloping surface 66 which mates with concave surface 21 of backing plate 20 and it is between these surfaces that blade 50 is clamped. The base of convex surface 66 joins a flat surface 67 which extends downward from surface 66 and in use mates with the opposing portion of surface 23 of plate 20. A square shaped slot 68 is cut into surface 67 adjacent the bottom edge. Square slot 68 aligns with semicircular grooves 32 and 38 to form an opening for the full length of the holder and in which resides shaft 60. Slot 68, unlike grooves 32 and 38 has straight sidewalls with no curvature and is designed so that flat side 64 of shaft 60 when the holder is open as in FIG. 8 aligns with and

rests against surface 68' (FIG. 8) of slot 68. A flat surface 69 on plate 65 mates with flat surface 33 of backing plate 20. A flat exterior surface 70 generally aligns with faces 44 of clamping plates 35, 36. A pair of unthreaded holes 71, 72 are formed in pivotal plate 65 which is pivotally secured to backing plate 20 by screws 73, 74 which pass through holes 71, 72, of somewhat larger diameter, and are screwed into holes 27, 28. A front tapered angle surface 75 extends from surface 70 to the end of convex slope 66 and it is this surface which guides the cut tissue.

As previously stated, disposable blades 50 suitable for use with this invention but without the usual guard member are manufactured and sold under various trademarks such as Personna and Weck. The desired character is illustrated by a description of blade 50. Blade 50 is of a length L_1 , greater than the length L_2 of pivotal plate 65 and is substantially greater in length than standard single or double edge razor blades so that cuts can be taken from large specimen blocks. That is, a specimen block up to at least L_2 length can be cut. In one embodiment, blade 50 is a Weck blade $2\frac{1}{4}$ inches by $\frac{1}{2}$ inches approximately, and of 0.010 inch thickness which allows the blade to be slid into the blade holder from the side and so that it resides between concave slope 21 and convex slope 66 and rests on ledge 22 of backing plate 20. Blade 50 preferably has a compound angled edge of microtome knife edge cutting quality but unlike single edge razor blades now on the market, blade 50 has no guard or banding member on the noncutting edge. That is, the conventional "Weck" or "Personna" single edge surgical blade is modified according to the invention by having the guard member removed. Removal of the guard member substantially enhances blade flexibility. Stainless steel is a preferred material for use in making blade 50. Chrome-carbon blades are acceptable where shorter storage periods exist and corrosion is no problem.

Reference will now be directed to the operation of the disposable blade and blade holder of thin invention. Once the holder is assembled as described and illustrated in FIG. 2, microtome clamp 13 is adjusted or tilted into an approximate 15° position towards feeding holder 12. The disposable blade holder of the invention is slid into the clamp 13 endwise so that clamping plates 35, 36 are in central alignment with jaws 14, 15. Once in position, jaws 14, 15 are tightened on sloped surfaces 43 of clamp plates 35, 36 and effectively lock the blade holder in clamp 13. Finger grip or control member 63 is turned so that flat side 64 of shaft 60 is in alignment with surface 68' of slot 68 of pivotal plate 65. With shaft 60 in this "unlocking" position, blade 50 is slid into the holder from the side so that it rests on ledge 22 between concave sloping surface 21 and convex sloping surface 66. Note here that plates 35, 36 and 20 form fixed blade shaped slots S_1, S_2 (fig. 5, 6) through which blade 50 can be slid from the side in a snug, slidable fit. Two slots S_1, S_2 insure the ability to push out the old blade with the new blade. With only one slot S_1 , the old blade can be lifted vertically, however the presence of two slots S_1, S_2 is much preferred. Once the blade 50 is in position, shaft 60 is rotated by turning finger grip 63 towards the operator. As shaft 60 is rotated, flat side 64 is rotated away from slot 68 and the circular portion of shaft 60 is brought into contact with surface 68' of slot 68 which causes central pivotal plate 65 to be pivoted slightly. Figs. 13 and 14 more clearly illustrate what takes place. FIG. 13 illustrates the open position or position in which shaft 60 has not yet been rotated but blade 50 has been placed in the holder in a snug fit. FIG. 14 shows plate 65 pivoted effect of shaft with slot 68. Convex surface 66 is moved forward against substantially the whole plane of blade 50 so that blade 50 is bent uniformly around a longitudinal axis until it is against concave surface 21. At this point, shaft 60 assumes a "locked" position holding blade 50 curved and with the edge of blade 50 stiffened and angled for proper cutting. This curving of blade 50 along with the tilting of clamp 13 provides a preferred total clearance angle of approximately 30° for blade 50's leading edge surface. Blade 50 once dulled can be replaced by reversing finger grip 63 so as to turn

cam member 60 back to the position of FIG. 8 which releases the blade. Blade 50 is then pushed endwise out of the holder as a new blade is being pushed in. Of significant importance is the fact that blades can be changed without removing the holder from clamp 13 which in turn eliminates loss of valuable sections due to retrimming of the section block as is necessary in disposable blade holders now in use. Also, blades 50 can be replaced from either side of the holder as preferred by the individual operator. Replacement blades are easily installed by simply turning cam shaft 60 into an "unlocking" position and inserting a new blade from either side usually determined by the operator being left or right handed. At no time is the operator exposed to sharp edges, which could nick or cut, while inserting a new blade. Blade thickness and curvature insure "locking" of shaft 60.

The invention thus eliminates conventional knives which are expensive in initial cost and require expensive and time consuming resharpening equipment as well as extra technician time for resharpening. Also, with conventional microtome knives repositioning of the knife clamp upon changing knives in necessary since each knife has a different dimension due to the wearing away of the material during sharpening. This has been eliminated. The holder of the invention has furthermore overcome the problem of 'chattering' or edge vibration experienced in prior art holders designed for wafer type disposable blades. Of particular significance is that by modifying the "Weck" or "Personna" type surgical blade by removing the guard member a disposable blade is obtained which when mounted in the holder of the invention provides cutting at least equal to and in many applications superior to microtome knife edge cutting quality. Removal of the guard member allows the blade to be flexed, i.e. curved around a longitudinal axis. Thus, even though the blade of the invention is normally difficult to flex, e.g. simply by holding and pressing between the fingers it is made to flex sufficiently for the invention by applying the force of the concave surface 66 over substantially the whole blade surface. The amount of curvature, preferably on about 1174 inches radius, is variable by adjusting screws 73, 74. Unlike prior art disposable blades and holders, e.g. U.S. Pat. No. 1,865,539, blade 50 is not required to be tensioned longitudinally. Since the holder and blade of the invention can be and necessarily are precision made each new blade acts precisely as the blade before and irrespective of the nature of the specimen. Such precision cutting therefore conforms to the precision of the microtome itself an accomplishment not heretofore achieved. Blade thickness, curvature and positioning always insures obtaining the same precise "locked" position of the parts.

What I claim is:

1. A microtome comprising, in combination:
 - a. a specimen holder mechanism including means for holding said specimen, means for applying a reciprocating motion to said specimen for cutting in a vertical plane and for advancing the reciprocating specimen and holder relative to the cutting plane;
 - a knife clamp adapted to clamp a conventional nondisposable microtome knife, said clamp being movable laterally and tiltable with respect to the specimen for appropriate precision positioning of the knife cutting edge;
 - c. a substantially rectangular uniform size disposable blade having one longitudinal edge precision sharpened to microtome knife quality for cutting and the opposed edge free of the conventional guard member, being of substantially less flexibility than the conventional double edge wafer blade while being adapted to being held clamped and slightly curved around a longitudinal axis when subjected to an appropriate bending force applied over substantially its entire plane; and
 - d. a holder for said disposable blade adapted to being received and held in said conventional knife clamp, comprising:
 1. a first horizontally disposed block member providing a pair of integral end portions having knife clamp sur-

- faces for clamping said holder within said knife clamp and providing between said knife clamp surfaces and proximate said cutting plane of a blade clamp concave backing surface for receiving said blade during loading in a noncurved relation and against which substantially the entire one side of said blade may be fixedly held in a curved relation during cutting, to place the cutting edge thereof in said cutting plane, at least one of said integral end portions having a slot-shaped to snugly fit and slidably receive said blade for loading from the corresponding end of said block member;
- a blade clamping member comprising a second block member having a slight and precise amount of inward-outward movement and mounted centrally of said first block member, said second block member having a convex surface mating said concave surface and said movement adapting said second block member at the end of its outward movement to provide with said concave surface a continuation of said slot to slidably and snugly receive said blade and at the end of its inward movement being adapted to contact and clamp substantially all but the cutting edge of the other opposite one side of said blade in a longitudinally tensionless free and predetermined curved relation between said concave and convex surfaces and to properly position the cutting edge thereof; and
3. a manually operated rotatable camming member mounted on said holder, said camming member being effective when rotated in one direction to cam said second block member in said slight outward movement so as to effect said slot and release said blade for replacement in an opposite direction to cam said second block member in said slight inward movement so as to clamp and curve said blade for cutting.
2. A microtome comprising, in combination:
- a. a tissue specimen holder mechanism including including means for holding, advancing and moving the specimen for precision cutting;
- b. a knife clamp for holding the conventional nondisposable microtome knife and of the type having a jaw structure with a pair of laterally spaced jaw members for gripping the conventional knife, means to open and close the jaw members and means for mounting the jaw structure as an integral unit such that it may be moved laterally and tilted with respect to the specimen for appropriate precision positioning of the knife cutting edge;
- c. a disposable blade characterized by being of predetermined standard dimensions relatively thin at least slightly flexible rectangular-shaped having a precision cutting edge of microtome knife quality formed on a lengthwise edge thereof and adapted when longitudinally tensionless and proper support and curvature around a longitudinal axis to cut all specimens normally cut by the conventional nondisposable microtome knife. being free of protective sanding members and the like on the remaining edges thereof, the length of said blade being at least slightly longer than the said lateral spacing of said jaw members and the width of said blade being equal to no more than a minor portion of the width of said conventional knife; and
- d. a disposable blade holder, comprising:
1. a first horizontally disposed substantially rectangular block member having end and central portions adapted to occupy a major portion of the space in said knife clamp normally occupied by said conventional knife, said end portions each having surfaces adapted to being clamped by a respective said jaw member and providing fixedly shaped slots formed by opposed internal front and back slot surfaces for snugly receiving and supporting the uncurved ends of said blade during loading, and during cutting each said portion adapting said blade end to be curved therein, said central portion of said block member providing a concave curved blade backing surface spanning said lateral spacing and prox-

- imate the upper edge of said first block member central portion and generally forming a continuation of the curvature of said end portion internal back slot surfaces;
2. a blade clamping member comprising a second block member spanning said lateral spacing and mounted for slight pivotal inward-outward movement on said central portion of said first block member and having a convex curved surface adapted to mate with said first block member central portion concave curved surface to form a slot continuing said end portion slots and whereby the whole of said blade except the cutting edge thereof may be slidably and snugly received when said second block member is moved outwardly and when said second block member is moved inwardly said blade may be rigidly clamped in a curved position between said first and second block members with the cutting edge thereof positioned for cutting said specimen; and
3. a camming member mounted in said blade holder and having camming means engageable to cam said second block and a movable manual control member such that when said control member is in a first position said second block convex curved surface is pivoted slightly away from said central portion concave curved surface and a substantially continuing uniform slot extends across the entire length of said blade holder for snugly and slidably receiving an endwise pushed said disposable blade and when said control member is in a second position said respective second block and central portion convex and concave curved surfaces grip and curve said blade therebetween with the cutting edge of said blade being at least slightly longer than said lateral spacing and extending slightly above the upper edges of said first and second block members and having a cutting angle determined both by the curvature of said blade and the tilt of said knife clamp.
3. A microtome as claimed in claim 2 wherein said camming member comprises an elongated rod member having a first section rotatably supported in said first block member and a second shaped section mounted to engage a corresponding shaped camming surface of said second block member to effect said pivotal movement and said movable manual control member comprises said rod being shaped at at least one end thereof with a finger hold for rotating said rod member.
4. A microtome as claimed in claim 3 wherein said manual movable control comprises said rod member having a pair of said finger holds being located at respective ends of said rod member.
5. A microtome as claimed in claim 2 wherein the precision of said knife clamp, blade, block members and camming member are coordinated in such manner that after a blade replacement the cutting edge of the new blade assumes the same precise position as that of the prior replaced blade, such precise position with said blade installed requiring only operator movement of said camming member and being automatically repetitively and precisely obtained on each movement to said second position said camming members being releasably locked by the forces produced by curving said blade.
6. A microtome comprising, in combination:
- a. a specimen holder mechanism including means for holding said specimen, means for applying a reciprocating motion to said specimen for precision cutting in a vertical plane and for advancing the reciprocating specimen and holder relative to the cutting plane;
- b. a knife clamp adapted to clamp a conventional nondisposable microtome knife, said clamp being movable laterally and tiltable with respect to the specimen for appropriate precision positioning of the knife cutting edge;
- c. a substantially rectangular uniform size disposable blade having one longitudinal edge precision sharpened to microtome knife quality for cutting and the opposed edge free of the conventional guard member, being of substan-

- tially less flexibility than the conventional double edge wafer blade while being adapted to being held clamped and slightly curved around a longitudinal axis when subjected to an appropriate bending force applied over substantially its entire plane; and
- d. a holder for said disposable blade adapted to being received held in said conventional knife clamp, comprising:
 1. a first horizontally disposed block member providing a pair of integral end portions having knife clamp surfaces for clamping said holder within said knife clamp and providing between said knife clamp surfaces and proximate said cutting plane a blade clamp substantially concave backing surface for receiving and seating said blade during loading in a noncurved relation and against which substantially the entire one side of said blade may be fixedly held and seated in a curved relation during cutting, to place the cutting edge thereof in said cutting plane, said integral end portions having slots shaped to snugly fit and slidably receive said blade for endwise loading from either respective corresponding end of said block member;
 2. a blade clamping member comprising a second block member having a slight and precise amount of inward-outward movement and mounted centrally of said first block member, said second block member having an outer sloped surface for receiving cut tissue and having an inner convex surface mating said concave surface and said movement adapting said second block member at the end of its outward movement to provide with said concave surface a continuation of said slot to slidably and snugly receive said blade and at the end of its inward movement being adapted to contact and clamp substantially all but the cutting edge of the other opposite one side of said blade in a longitudinally tensionless free and predetermined curved relation between said concave and convex surfaces and to properly position the cutting edge thereof; and
 3. a manually operated rotatable member mounted on said holder, said rotatable member being effective when rotated in one direction to move said second block member in said slight outward movement to a first position so as to effect said slot and release said blade for replacement and in an opposite direction to move said second block member in said slight inward movement to a second position so as to clamp and curve said blade for cutting, the thickness, position and curvature of said blade being such as to provide forces effective to releasably lock said rotatable member in said second position.
- 7. A microtome comprising, in combination:
 - a. a specimen holder mechanism including means for holding said specimen, means for applying a reciprocating motion to said specimen for precision cutting in a vertical plane and for advancing the reciprocating specimen and

- holder relative to the cutting plane;
- b. a knife clamp adapted to being movable with respect to the specimen for appropriate precision positioning of the knife cutting edge;
- c. a substantially rectangular uniform size disposable blade having one longitudinal edge precision sharpened to microtome knife quality for cutting and the opposed edge free of the conventional guard member, being of substantially less flexibility than the conventional double edge wafer blade while being adapted to being held clamped and slightly curved around a longitudinal axis when subjected to an appropriate bending force applied over substantially its entire plane; and
- d. a holder for said disposable blade adapted to being received and held in said knife clamp, comprising:
 1. a first horizontally disposed block member providing a pair of integral end portions having knife clamp surfaces for clamping said holder within said knife clamp and providing between said knife clamp surfaces and approximate said cutting plane a blade clamp substantially concave backing surface for receiving and seating said blade during loading in a noncurved relation and against which substantially the entire one side of said blade may be fixedly held and seated in a curved relation during cutting, to place the cutting edge thereof in said cutting plane, said integral end portions having slots shaped to snugly fit and slidably receive said blade for endwise loading from either respective corresponding end of said block member;
 2. a blade clamping member comprising a second block member having a slight and precise amount of inward-outward movement and mounted centrally of said first block member, said second block member having an outer sloped surface for receiving cut tissue and having an inner convex surface mating said concave surface and said movement adapting said second block member at the end of its outward movement to provide with said concave surface a continuation of said slot to slidably and snugly receive said blade and at the end of its inward movement being adapted to contact and clamp substantially all but the cutting edge of the other opposite one side of said blade in a longitudinally tensionless free and predetermined curved relation between said concave and convex surfaces and to properly position the cutting edge thereof; and
 3. a manually operated rotatable member mounted on said holder, said rotatable member being effective when rotated in one direction to move said second block member in said slight outward movement to a first position so as to effect said slot and release said blade for replacement and in an opposite direction to move said second block member in said slight inward movement to a second position so as to clamp and curve said blade for cutting.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTIONPatent No. 3,599,523 Dated August 17, 1971Inventor(s) John E. P. Pickett

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 9, "holders constructions" should be deleted and -blade holder constructions- should be inserted.

Col. 1, line 24, "Patent No. 1.026,280" should be -Patent No. 1,026,280-.

Col. 1, line 31, after "1,865,539" a -;- should be inserted.

Col. 1, line 40, after "tissue" the word -specimens- should be inserted.

Col. 1, line 74, "-wafer" should be -"wafer"-.

Col. 2, line 51, "releasable" should be -releasably-.

Col. 2, line 53, after "microtome" the word -knife- should be inserted.

Col. 2, line 61, "an" should be -and-.

Col. 2, line 75, "1174 inches" should be -1 1/4"-.

Col. 4, line 16, "cross" should be -across-.

Col. 4, line 43, after "surface" the number -40- should be inserted.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTIONPatent No. 3,599,523 Dated August 17, 1971Inventor(s) John E. P. Pickett

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 5, line 15, "L₁" should be -L-1-.

Col. 5, line 16, "L₂" should be -L-2-.

Col. 5, line 19, "L₂" should be -L-2-.

Col. 5, line 36, "thin" should be -this-.

Col. 5, line 66, after the word "Pivoted" insert -forward slightly about the edge of ledge 22 by the camming-.

Col. 5, line 66, after "shaft" the number -60- should be inserted.

Col. 5, line 74, "Blade 50" should begin a new paragraph.

Col. 6, line 25, 'chattering' should be -"chattering"-.

Col. 6, line 39, "1174" should be -1 1/4"-.

Col. 6, line 58, "b." for the subparagraph is left off completely.

Col. 7, line 3, "of" should be deleted.

Col. 7, line 12, "2" for the subparagraph was left off completely

Col. 7, line 33, "an", first occurrence, should read -- and --;

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTIONPatent No. 3,599,523 Dated August 17, 1971Inventor(s) John E. Pickett

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 7, line 33, "an" should be -and-.

Col. 7, line 44, "members" should be deleted in its first use.

Col. 7, line 54, "under" should appear after -and- in its first use.

Col. 7, line 55, "." after knife should be -, - .

Col. 7, line 56, "sanding" should be -banding-.

Col. 7, line 72, after the word "said" in its first use insert -end- .

Col. 8, line 60, after the word "position" insert -of said control member, and in such second position-.

Col. 8, line 60, "members" should be -member-.

Col. 9, line 7, after "received" insert -and-.

Col. 10, line 20, "approximate" should be -proximate-.

Signed and sealed this 4th day of April 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents