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METHOD FOR MEASURING THE TRUE CUTTING EDGE
ANGLE OF A KNIFE FOR A MICROTOME
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Fig. 1

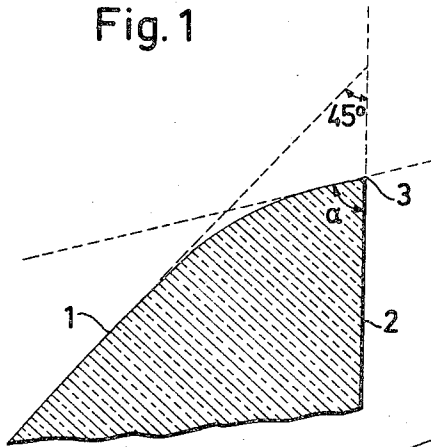
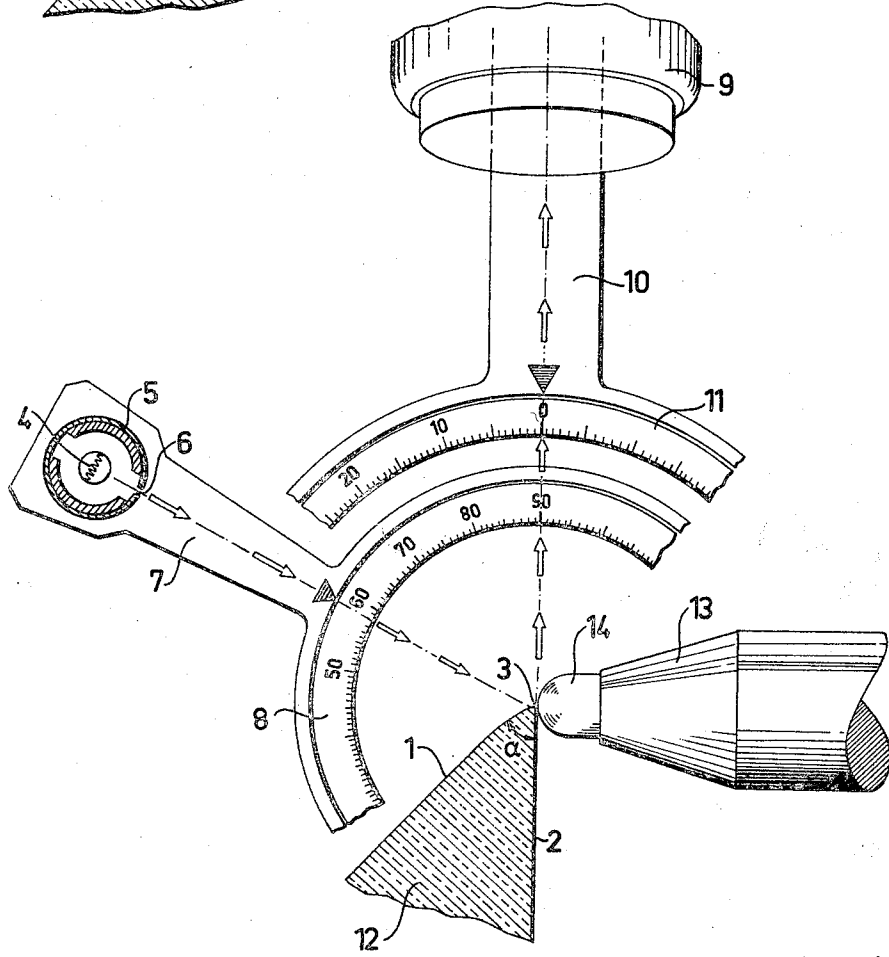


Fig. 2



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**METHOD FOR MEASURING THE TRUE CUTTING
EDGE ANGLE OF A KNIFE FOR A MICROTOME**
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7 Claims. (Cl. 83—13)

ABSTRACT OF THE DISCLOSURE

The true edge angle of a knife for a microtome is determined by directing a ray of light through a narrow slot towards the knife surface adjacent the cutting edge, observing the direction of the light ray reflected by the knife's surface, and calculating the orientation of the knife's surface from the directions of the incident and reflected light rays respectively.

This invention relates to a method and an apparatus for measuring the true angle of the cutting edge of a knife to be used in a microtome. The invention also relates to a microtome containing an apparatus for measuring the true knife edge angle.

The true edge angle of a knife for a microtome is often different from the edge angle which can be observed with the naked eye, owing to the fact that the surface of the knife is curved close to the edge. Such a curved edge surface is produced in an uncontrollable way not only when knives of metal or diamond are sharpened but also when a glass plate is broken so as to form a knife. The invention aims at finding the true cutting edge angle, that is the angle between the surfaces in close proximity to the edge.

The method of the invention is characterized by directing a ray of light through a narrow slot towards the knife surface adjacent the cutting edge, observing by means of a microscope the direction of the ray of light reflected by said surface, and calculating the orientation of the surface by means of the directions of the incident and reflected rays of light.

The apparatus of the invention is characterized by containing a holder to secure the knife with its cutting edge in a predetermined position, illumination means having a narrow slot for directing a ray of light towards the knife close to the cutting edge, a microscope for observing the ray of light having been reflected by the knife surface, and means for rotating the knife, the illumination means or the microscope around the knife edge.

The width of the slot is preferably 0.1–0.01 mm. The microscope should preferably have a magnification of 10–100.

The invention will now be explained with reference to the accompanying drawing. FIG. 1 illustrates the cutting edge of a glass knife of a microtome, and FIG. 2 illustrates a portion of a microtome containing an apparatus for measuring the true cutting edge angle.

FIG. 1 shows a portion of a glass knife which has been manufactured from a square glass plate, by the plate having been broken along a score line extending substantially between two corners of the plate. The visible edge angle is consequently 45°. However, in the breaking operation the new knife surface 1 will be curved in close proximity to the original peripheral surface 2 of the glass plate. The true cutting edge angle α , which will be the effective cutting edge angle when a specimen is being cut in the microtome, is approximately 75° in the illustrated case.

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The microtome, part of which is illustrated in FIG. 2, contains a glass knife 12 of the same type as that of FIG. 1. The knife is fastened in a holder, not illustrated, with its cutting edge 3 extending at right angle to the plane of the drawing. The microtome also contains a specimen holder 13, on which the specimen 14 to be cut is fastened. The specimen holder 13 is connected to means giving it a movement towards the knife 12 and a reciprocating movement up and down, resulting in the specimen 14 being sliced by the cutting edge 3. Such means for moving the specimen holder are well known to any person skilled in the art, and have not been illustrated. The microtome also contains illumination means comprising a lamp 4 and a reflector 5 having a narrow slot 6 extending parallel with the knife edge 3. The slot 6 has a width of 0.01 mm. and a length substantially equal to that of the cutting edge, i.e. the thickness of the glass plate from which the knife was made. The illumination means is fastened to an arm 7 which is rotatable around an axis of rotation, which coincides with the knife edge 3. Close to the arm 7 is a scale 8 indicating the desired cutting edge angle. The microtome also contains a microscope 9 mounted on an arm 10 which can be rotated around an axis coinciding with the cutting edge 3. Close to the arm 10 is a scale 11 indicating the position of the microscope.

In the microtome of FIG. 2 the plane knife surface 2 and the optical axis of the microscope 9 are situated in the same vertical plane. When the cutting edge angle is to be measured the operator rotates the illumination means 4–6 until he observes in the microscope, the focal plane of which coincides with the cutting edge 3, the image of the narrow slot 6, and until said image has a maximal intensity of light and is situated close to the cutting edge 3. The scale 8 now discloses the cutting edge angle, which is 58° in the illustrated case. The graduation of the scale 8 is easily understood if, first, the case is considered that the cutting edge angle is 45°, resulting in a horizontal illumination means, and, second, the case is considered that the cutting edge angle is 90°, resulting in a vertical illumination means.

The image of the slot 6 observed in the microscope gives additional information on the quality of the curved knife surface close to the edge. If, for instance, the image is at some place particularly close to the cutting edge, this means that the cutting edge angle at said place is larger than the average. A straight and even image indicates a straight cutting edge having an evenly curved surface without any irregularities.

In the microtome of FIG. 2 the plane knife surface 2 is vertical. The specimen 14 which is being cut moves vertically in the very moment of cutting. Consequently, the clearance angle will be naught. The knife holder, not illustrated, should preferably be adjustable, so that the knife 12 can be fixed in a position in which the plane surface 2 produces the desired clearance angle. The microscope is fixed, by means of the scale 11, in an angle to said clearance angle. When the illumination means has been placed in the correct position as described above, the scale 8 discloses the true edge angle.

In the illustrated microtome the knife and the microscope are kept fixed during the measuring operation, while the illumination means is being rotated. It is within the scope of the invention to keep the knife and the illumination means fixed while the microscope is being rotated. It is also within the scope of the invention to keep the microscope and the illumination means fixed while the knife is being rotated.

What is claimed is:

1. A method for measuring the true cutting edge angle of a knife for a microtome, which comprises positioning the knife edge and a microscope in the same plane; di-

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recting a ray of light through a narrow slot towards the surface of the knife close to the cutting edge; measuring the angle between the ray source and the microscope; observing through the microscope the direction of the ray of light reflected from said surface; and calculating the orientation of said surface by means of the incident and reflected rays of light.

2. A method as claimed in claim 1, characterized in keeping the knife and the microscope fixed while varying the position of the slot.

3. A method as claimed in claim 1, characterized in keeping the knife and the slot fixed while varying the position of the microscope.

4. A method as claimed in claim 1, characterized in keeping the slot and the microscope fixed while varying the position of the knife.

5. A method for measuring the true cutting edge angle of a microtome knife of the type in which the cutting edge is defined by a plane surface and a curved surface, comprising fastening the knife with the plane surface in a predetermined orientation, passing a ray of light through a narrow slot towards the curved surface, measuring the direction of said ray of light, observing the ray of light after having been reflected from said curved surface, measuring the direction of said reflected ray of light, and calculating the orientation of said curved surface from the directions of the rays of light thus measured.

6. An apparatus for measuring the true cutting edge angle of a stationary knife for a microtome, which comprises:

an illumination means, including a light slot having a width of 0.01–0.1 mm., for passing a ray of light towards a surface of the knife immediately adjacent the cutting edge of said knife;

a microscope, the cutting edge of the knife lying in the plane of the optical axis of said microscope;

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means for rotating the illumination means about an axis coinciding with the cutting edge of said knife, whereby an incident light ray is reflected in the plane of the optical axis of said microscope; and

scale means for measuring the orientation of said illumination means with respect to said microscope.

7. An apparatus for measuring the true cutting edge angle of a stationary knife for a microtome, which comprises:

an illumination means, including a light slot having a width of 0.01–0.1 mm., for passing a ray of light towards a surface of the knife immediately adjacent the cutting edge of said knife;

a microscope, the cutting edge of the knife lying in the plane of the optical axis of said microscope;

means for rotating the microscope about an axis coinciding with the cutting edge of said knife whereby to move the microscope into a position in which the cutting edge of the knife lies in the plane of the optical axis of the microscope whereby an incident light ray, from said illumination means, is reflected in the plane of the optical axis of the microscope; and

scale means for measuring the orientation of the microscope with respect to said illumination means.

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