Jan. 16, 1968 RYUICHI MASUO ET AL 3,363,949

CROSS KNIFE EDGE

Filed June 7, 1965

Fig. 1
PRIOR ART

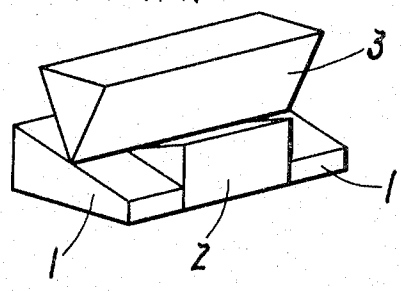


Fig. 2
PRIOR ART

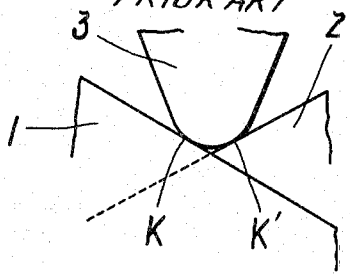


Fig. 3

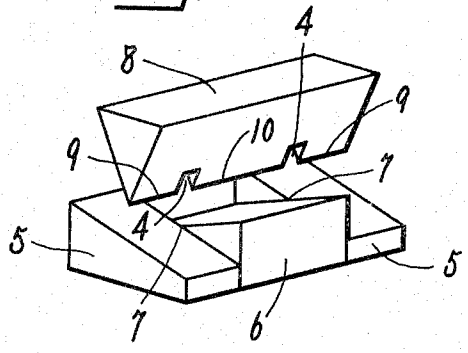


Fig. 4

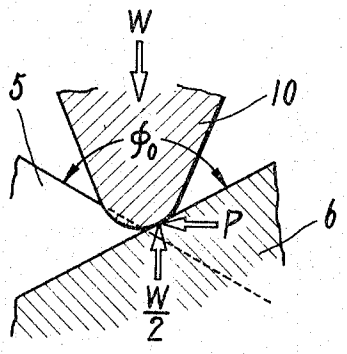
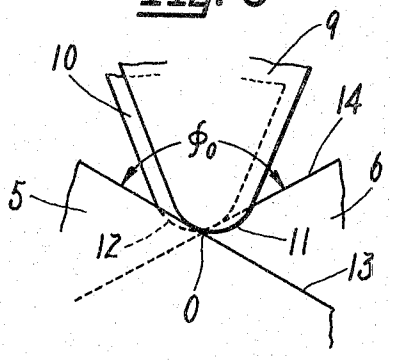


Fig. 5



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CROSS KNIFE EDGE

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1 Claim. (Cl. 308—2)

ABSTRACT OF THE DISCLOSURE

The present application is concerned with an improvement in the edge of the cross knife to be used for fulcrums and the loading point of lever beams in balances or material testing machines.

Description

An object of the present invention is to overcome variations in equilibrium of lever beams caused by contact of knife blades with blade supports.

Another object of the present invention is to provide improved means for keeping points of contact of a knife blade with a blade support in a cross knife edge just or nearly alined. In the above and in the following, "alined" or "alinement" is not used in the plane geometrical meaning but in the spatial meaning.

A further object of the present invention is to provide improved means for keeping points of contact of the knife blade with the blade support just or nearly alined in cases wherein a balance or a material testing machine is brought into use.

Still other objects of the present invention and how the foregoing objects and advantages are attained will be apparent from the following description referring to the accompanying drawings in which:

FIG. 1 is an oblique view of a conventional cross knife edge.

FIG. 2 is a side view of a cross knife edge shown in FIG. 1.

FIG. 3 is an ablique view of an embodiment of the cross knife edge according to the present invention.

FIG. 4 is a schematic diagram for explaining the displacement of the blade edge in the cross knife edge according to the present invention.

FIG. 5 is a magnified side view of the blade edges in contact with the blade support blocks.

The knife edge is used for fulcrums and loading points in balances or material testing machines. And a conventional knife edge is the combination of a knife blade and a blade support having a shallow V-shaped cross section and supporting said blade along its edge.

With such a conventional knife edge, when a force in a horizontal direction acts on the blade by a certain cause, the blade edge displaces in said direction and position of contact of the blade edge with the support changes. Such a change of position of contact causes unbalance of moment and variation in lever beam equilibrium.

To overcome the variation in lever beam equilibrium due to the horizontal displacement of the blade edge, the cross knife edge as shown in FIG. 1 has been devised. Such a cross knife edge is provided with a blade support having a support block **1** with a slant plane surface in combination with another support block **2** with a plane ssurface having an opposite slant to the slant of the plane surface of support block **1**.

However, with such a cross knife edge, the blade **3** comes into contact with the support at two different points which are shown at K and K' in FIG. 2. The defect of such a feature of contact of the blade with the support will be seen in the following description.

When the blade begins to tilt, slippage occurs at faces of contact of the blade with the support and friction results. This friction causes variation in lever beam equilibrium. Further, the reactive forces at two different points of contact of the blade with the support are different normally. Such a difference of reactive forces gives such an effect as if the position of the fulcrum on the lever beam has been displaced. And, by such an effect, variation in the lever beam equilibrium also results.

Now, new cross knife edges have been made known by the present inventors' Japanese Patent No. 442,534. These new knife edges have been devised so as to maintain the points of contact of the blade with the blade support alined, by means of placing the circle centers apart, which respective circle forming the vertical section of the respective blade edge portion.

In the aforementioned Japanese patent, various portions of a blade edge are given a displacement artificially prior to setting the blade on the support. Said portions of the blade edge are respectivly in contact with a support block having a contact plane surface with an opposite slant to the contact plane surface of the adjacent support block. However, from the manufacturing and adjustment points of view, means for providing such an artificial displacement properly in a small blade edge have difficulties.

Turning now to the cross knife edge according to the present invention, it will be seen in FIG. 3 that the blade edge is provided with notches **4**. Said notches are positioned over the positions **7** at which the slant planes of support **5** and **6** intersect. Accordingly, the edge portions **9** and **10** of the blade edge which are separated by notches **4** are positioned in alinement before the blade is put on the blade support, but when a load acts on blade **8** it is distorted at its edge. This distorted state of the blade is allustrated in FIG. 4 in which the blade edge is shown at **10** and the support blocks at **6** and **5**. Assuming that W is the load which acts on the blade, the blade edge receives a vertical stress W/2 and a horizontal stress P at its point of contact with support block **6**. And,

$$P=W/2\cot\phi_0/2$$

(where ϕ_0 is the angle of intersection between support blocks **6** and **5**).

The blade edge is forced to be displaced sideways by horizontal stress P.

FIG. 5 is shown in an ideally state of blade edge portions **9** and **10** by a load which acts on the blade. In such a state, circular faces **11** and **12** respectively of blade edge portions **9** and **10** intersect at point of intersection **0** of slant face planes **13** and **14** of the respective support blocks. Accordingly, it will be seen that the points of contact of the blade edge portions with the blade support are made alined.

Naturally, the amount of flexure of the respective blade edge varies in accordance with the intensity of the load, and the blade edge portions will not always be maintained at the ideal state as shown in FIG. 5. However, it is in any circumstances expected that in the course of use said blade edge portions approach to said ideal state.

The fundamental object of displacing a blade edge is to bring the points of contact which are normally dual in alinement, and even if this alinement is not sufficiently attained, an effect of decrease in variation in equilibrium of the lever beams can be expected by the approach of said points of contact. And, although the displacement of the blade edge which is due to the provision of the notches is very small in its amount, it certainly manifests the effect of the above description because the radius of curvature in the blade edge portion vertical section is as small as several microns.

Having thus described our invention what we claim is:

1. In a cross knife edge of the kind comprising a knife

blade in contact with blade support blocks and mounted thereon, each said support block having a plane surface touching the edge of said knife blade and being oppositely slanted to the plane surface of the adjacent support block, in which said cross knife edge has the knife blade provided with notches in its blade edge with each said notch being positioned over the portion of intersection of said support block slant surfaces whereby upon action of a load on said knife blade, different edge portions of said knife blade with said notch therebetween will be displaced sideways and in opposite directions causing points of contact of said knife blade with said blade support blocks to be aligned.

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