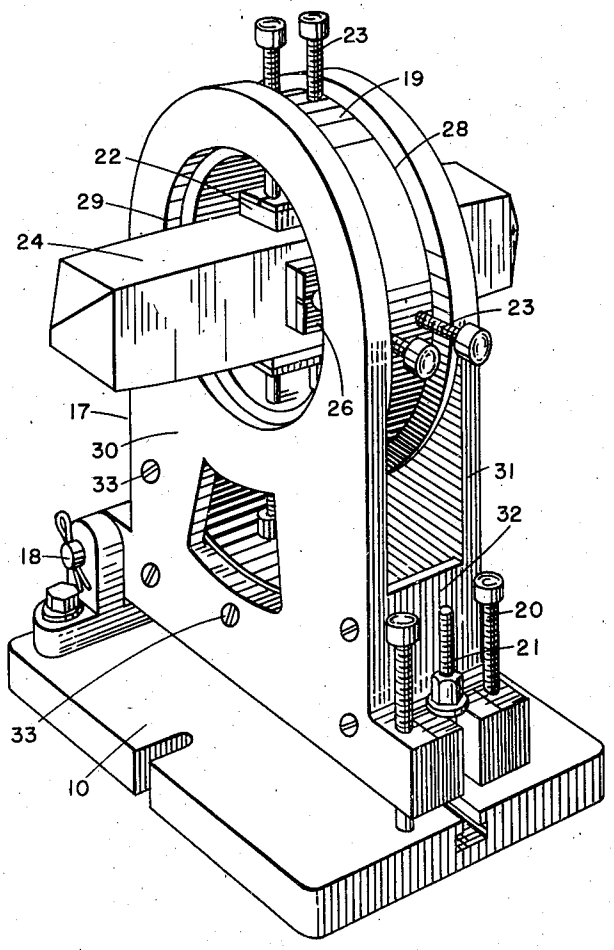
March 4, 1947. W. P. MARSHALL 2,416,703

CRYSTAL INDEXING FIXTURE

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Fig. 1



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Fig. 2

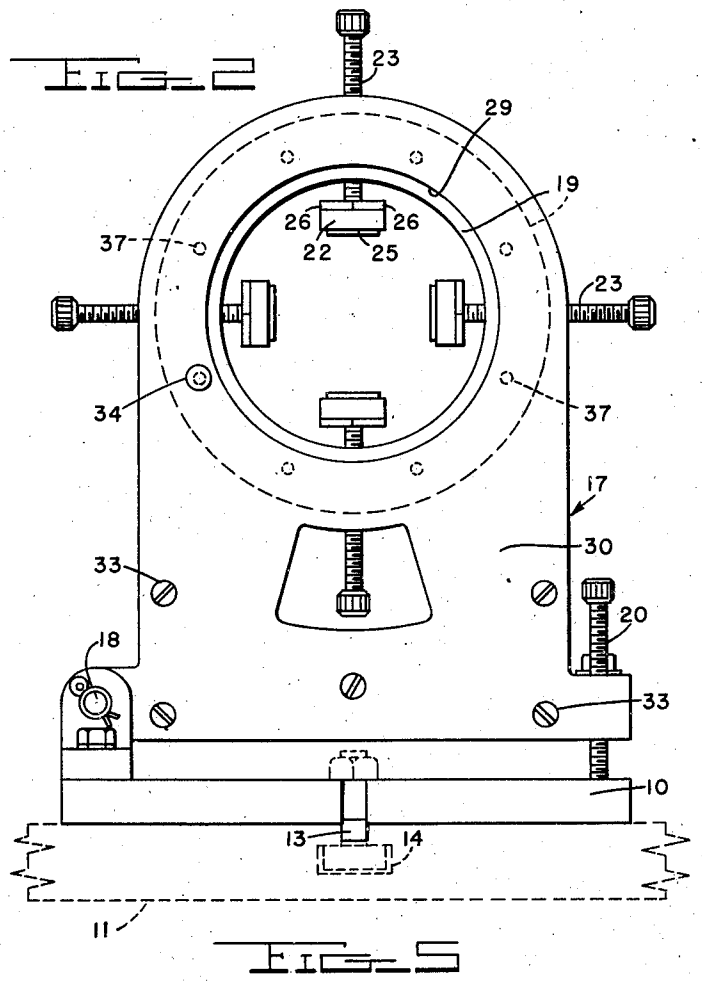
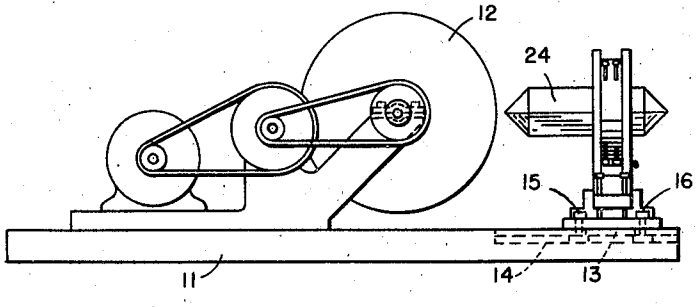


Fig. 5



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FIG. 3

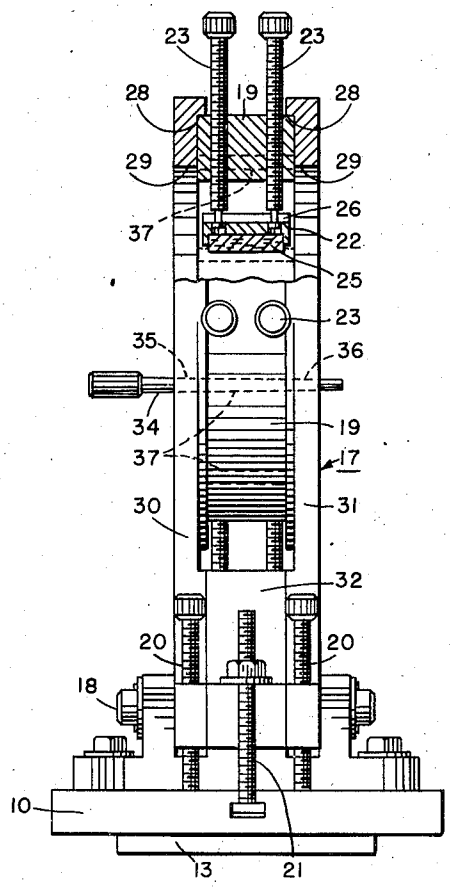
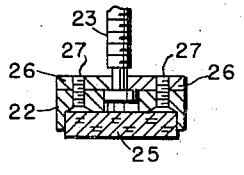


FIG. 4



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Patented Mar. 4, 1947 2,416,703

UNITED STATES PATENT OFFICE

2,416,703

CRYSTAL INDEXING FIXTURE

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Application June 22, 1945, Serial No. 601,051

4 Claims. (Cl. 51—217)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The present invention has to do with the production of piezoelectric crystal elements and more particularly the cutting of piezoelectric elements from a crystal or portion of a crystal of piezoelectric material with reference to certain axes of the crystal.

An important requirement to the attainment of accuracy, economy and rapid production in such cutting is the provision of means for firmly holding the piece of crystal material in various predetermined positions relative to the cutting tool, in a manner to afford operation of the tool on a large portion of the material in a single operation, and to afford rapid and accurate re-adjustment of the relative position of tool and work-piece for other operations of the tool on the work-piece without disturbing other angular relations intended to remain constant.

It is therefore an object of the invention to provide a holding fixture in which the crystal may be adjustably held in any position within a substantial range of adjustment sufficient to bring crystals of different sizes and slight variation in shape, into a position to align a given axis of the crystal with the cutting plane of the tool, the fixture being capable of permitting readjustment of the position of the crystal with reference to the tool to change the angular relation of another axis or axes to the tool while maintaining the first alignment.

Another object is to provide in such a fixture, an indexing means whereby once the fixture is adjusted to hold the crystal with one axis in alignment with the tool, the crystal may be adjusted about this axis in predetermined angular steps.

Another object is the provision of means whereby the crystal may be adjusted about the first mentioned axis independently of the indexing means.

A further object is to provide a crystal holder which together with the quality of adjustability shall be capable of affording free access to a large portion of the crystal by the tool.

Various other objects and advantages of the invention will become apparent upon perusal of the following specification and the drawings accompanying the same.

In the drawings:

Fig. 1 is a perspective view, approximately one half size, of a practical embodiment of the invention.

Fig. 2 is a front plan view of the same.

Fig. 3 is a side elevation looking from the right at Fig. 2, and partly in section.

Fig. 4 is a cross-sectional view of one of the

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clamping shoes taken through the axis of one of the clamping screws in a plane normal to the cross-sectioned portion of Fig. 3.

Fig. 5 is a side elevation on a much reduced scale and in diagrammatic form, showing the crystal holder and a cutting tool in operative relation.

Referring to the drawings more in detail, the device is comprised of a carriage element 10 adapted to be removably mounted on the bed-plate 11 of a cutting tool such as a cutting disk 12, in fixed angular relation to the tool in all three dimensions, the angular relation being fixed in any known or other suitable manner as by a feather-key or spline 13 in slidable engagement with a longitudinal T-slot 14 formed in the bed, while fixation is obtained through clamping bolts 15 and 16. A support member 17 pivotally mounted on the carriage 10 through means of a pintle 18, supports a ring-form crystal holder 19 rotatably mounted in the support, about an axis parallel to the axis of the pintle 18, both fixed relative to the carriage 10 and consequently fixed relative to the tool bed 11.

A pair of leveling screws 20 threaded in the end of the support opposite the pivoted end and bearing upon the upper surface of the carriage 10, together with a locking bolt 21, afford a small angular adjustment of the support about the axis of the pintle and consequently an angular adjustment of the holder 19 in its plane of rotation for adjustment of the holder, and a crystal held therein, to a given starting or zero, angular position with reference to the carriage 10 and tool 12.

Clamping shoes 22 carried by the holder 19, and adjustable radially of the holder through clamping bolts 23 in threaded engagement with the holder, serve to adjustably hold and clamp a crystal to be operated upon, such as the crystal 24 (Fig. 1), at various angles to the axis of the ring-form holder within a substantial range of adjustment sufficient to bring the longitudinal axis of crystals of different sizes and slight variation in shape, into alignment with the axis of the ring-form holder.

To compensate for irregularities in the lateral surfaces of a crystal, the clamping shoes 22 are afforded a slight universal movement each through provision of a slightly loose fit to the ends of its clamping screws 23, and the provision of a cork pad 25, the latter, due to its resiliency, tending to conform to vary slight surface irregularities.

Loose connection of the shoe 22 with the clamping screw 23 is obtained through the use

of a pair of yoke elements 26 secured by screws 27 and embracing the neck portion of the headed end of the clamping screw.

The ring-form holder 19 has bearing in the support 17 by virtue of its loose fit in the two inwardly facing, annular, rabbeted portions 28 formed about the openings 29 in the front and rear plates 30 and 31 which plates with the spacer member 32 constitute the body of the support 17. The plates and spacer member may be secured together in any known or other suitable manner as by clamping screws as shown at 33 in Figs. 1 and 2.

A centering pin 34 passing through registering openings 35 and 36 in the support 17 and one of a series of openings 37 in the ring-form holder 19 provides means for locking the holder against rotation in the support. This enables the holder to be locked in a starting or zero position relative to the support during adjustment of the crystal in the holder and adjustment of the support 17 about the axis of the pintle 18 to adjust the angle of the crystal in the plane of rotation of the holder. The several openings 37 distributed around the holder in definite angular spacing, enable the holder and consequently the crystal to be indexed angularly in either direction from the starting or zero position by withdrawing the centering pin, rotating the holder to bring the next or other desired one of the openings 37 into register with the openings in the support, and locking the parts in adjusted position by reinsertion of the pin 34. To insure accuracy of indexing and facilitate insertion of the pin, the openings and the pin are given a tapering fit, tapering from the head to the far end of the pin whereby after rotating the holder to bring the selected set of holes into approximate register, with very slight variation from concentricity, the smaller end of the pin will readily enter the approximately aligned openings and draw them into accurate alignment to lock the holder in the new predetermined angular position.

In operation the crystal 24 is first accurately adjusted and clamped in the holder by means of the adjustable clamping shoes and the angular adjustment afforded by the leveling screws 20, to bring certain axes of the crystal into a predetermined orientation relative to the carriage member 10. In the present instance the crystal 24 is one in the form of an elongated rectangular prism with rectangular pyramidal ends, to be cut or sliced along planes parallel to the longitudinal axis of the crystal and at 45 degrees to the side faces. After the crystal has been clamped in the holder with its three axes orientated in parallelism with the three rectangular axes (longitudinal, vertical and transverse horizontal), of the carriage 10, as indicated in Fig. 1, the carriage being clamped on the bed of the cutting tool, the pin 34 is withdrawn and the crystal indexed 45 degrees about the axis of the holder as indicated in Fig. 5 and locked in this position by reinsertion of the pin. Now, movement of the cutting tool 12 toward the crystal will result in a slicing cut into the crystal which followed by three other slicing cuts, each after an indexing of the crystal through an additional 90 degrees will cut from the mother crystal a rectangular prism aligned with the longitudinal axis of the original prism but having its sides canted at 45 degrees to those of the mother crystal.

Provision of the spline 13 or equivalent position-determining means on the carriage member 10, enables the crystal to be originally adjusted in the holder in the desired orientation with respect to the carriage while situated at some place more convenient than the tool bed, as on a special adjusting bed or bench not shown, providing ready access to the crystal for the application of suitable measuring and indicating devices for determining correct adjustment, the spline assuring an orientation of the carriage with respect to the tool bed the same as it had with the bed or bench on which the alignment of the crystal was established.

Obviously the original alignment of the crystal may be made with the carriage mounted on the tool bed. Determination of proper alignment may be made in any known or other suitable manner as by determination of the angular relation of the crystal faces to the carriage.

While only one practical embodiment of the invention has been herein shown and described for the sake of disclosure, it is to be understood that the invention is not limited to the specific embodiment disclosed, but contemplates all such modifications and variations thereof as fall fairly within the scope of the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. A crystal indexing fixture comprising a carriage, a support pivotally mounted on the carriage to swing about an axis fixed relative to the carriage, said support comprising a pair of upright front and rear plates spaced apart parallel and having circular, openings with rabbeted rims facing each other, a ring form crystal holder mounted between said plates with its opposite ends fitted into said rabbeted rims for rotation therein, a plurality of pairs of clamping screws extending radially through the holder between the plates, each pair terminating within the holder at a work-clamping shoe supported at spaced points on the ends of the screws for slight universal movement relative thereto, whereby a crystal may be clamped in the ring-form holder and adjusted angularly with respect to the axis of the ring-form holder.

2. A crystal indexing fixture comprising a carriage, a support pivotally mounted on the carriage to swing about an axis fixed relative to the carriage, said support comprising a pair of upright front and rear plates spaced apart parallel and having circular openings with rabbeted rims facing each other, a ring form crystal holder mounted between said plates with its opposite ends fitted into said rabbeted rims for rotation therein, a plurality of pairs of clamping screws extending radially through the holder between the plates, each pair terminating within the holder at a work-clamping shoe supported at spaced points on the ends of the screws for slight universal movement relative thereto, whereby a crystal may be clamped in the ring-form holder and adjusted angularly with respect to the axis of the ring-form holder, together with indexing means for locking the ring-form holder in various predetermined angular adjustments relative to the support.

3. A crystal indexing fixture comprising a carriage, a support pivotally mounted on the carriage to swing about an axis fixed relative to the carriage, said support comprising a pair of

upright front and rear plates spaced apart parallel and having circular, openings with rabbeted rims facing each other, a ring form crystal holder mounted between said plates with its opposite ends fitted into said rabbeted rims for rotation therein, a plurality of pairs of clamping screws extending radially through the holder between the plates, each pair terminating within the holder at a work-clamping shoe supported at spaced points on the ends of the screws for slight universal movement relative thereto, whereby a crystal may be clamped in the ring-form holder and adjusted angularly with respect to the axis of the ring-form holder, together with a centering pin passing through registering openings in the plates and one of a circular series of openings in the ring form holder.

4. A crystal indexing fixture comprising a carriage, a support pivotally mounted on the carriage to swing about an axis fixed relative to the carriage, said support comprising a pair of upright front and rear plates spaced apart parallel and having circular openings with rabbeted rims facing each other, a ring form crystal holder mounted between said plates with its opposite ends

fitted into said rabbeted rims for rotation therein, a plurality of pairs of clamping screws extending radially through the holder between the plates, each pair terminating within the holder at a work-clamping shoe supported at spaced points on the ends of the screws for slight universal movement relative thereto, whereby a crystal may be clamped in the ring-form holder and adjusted angularly with respect to the axis of the ring-form holder, the clamping screws in each pair being spaced axially of the ring-form holder.

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