

Feb. 12, 1946.

J. C. LULEY

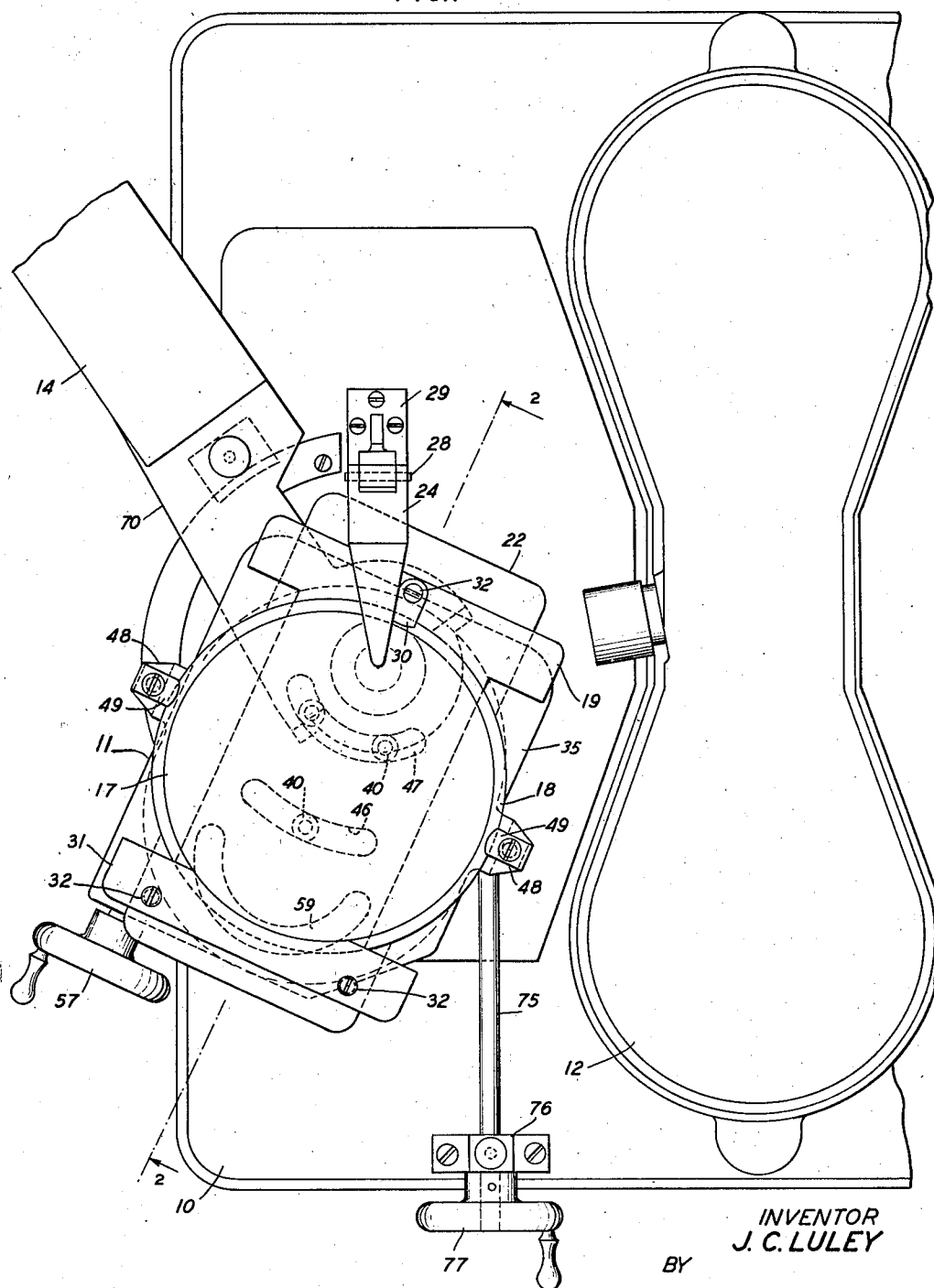
2,394,622

ORIENTING DEVICE

Filed Oct. 19, 1943

4 Sheets-Sheet 1

FIG. 1



INVENTOR
J. C. LULEY
BY
E. R. Nowlan
ATTORNEY

Feb. 12, 1946.

J. C. LULEY

2,394,622

ORIENTING DEVICE

Filed Oct. 19, 1943

4 Sheets-Sheet 2

FIG. 2

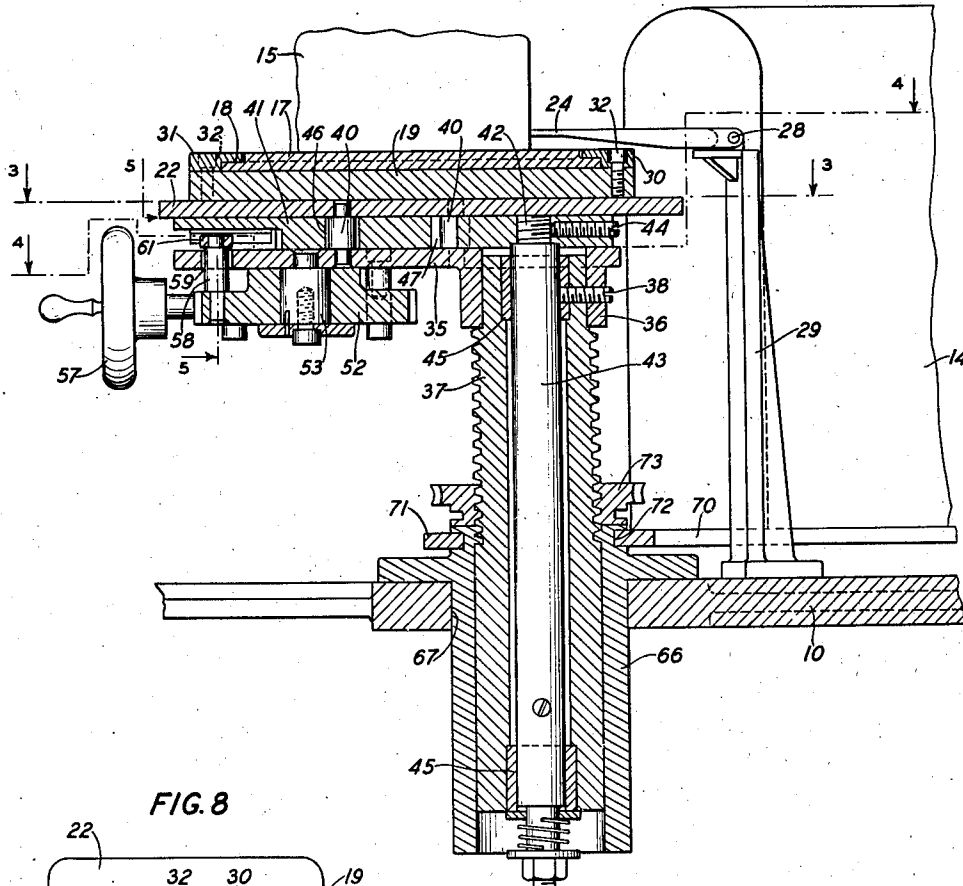
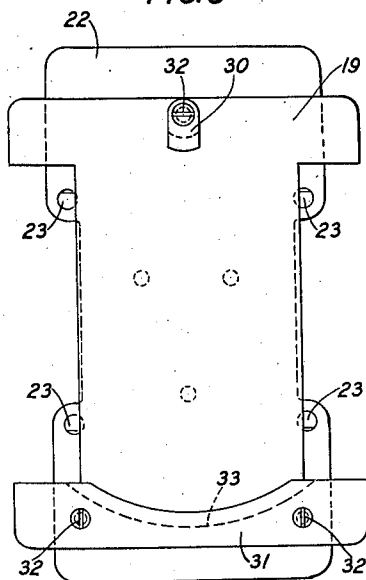


FIG. 8



INVENTOR
J. C. LULEY
BY
E. R. Nowlan
ATTORNEY

Feb. 12, 1946.

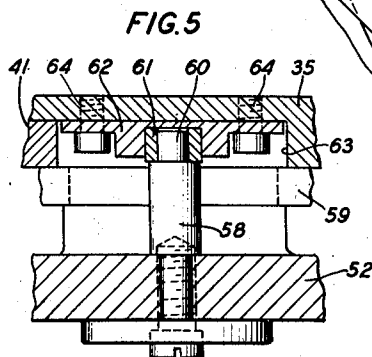
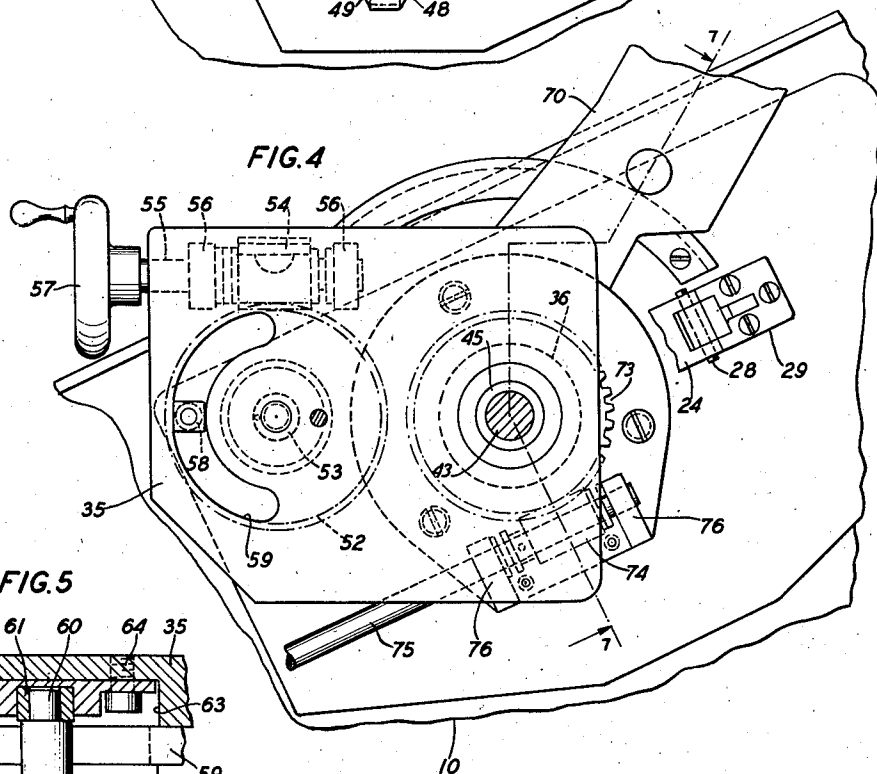
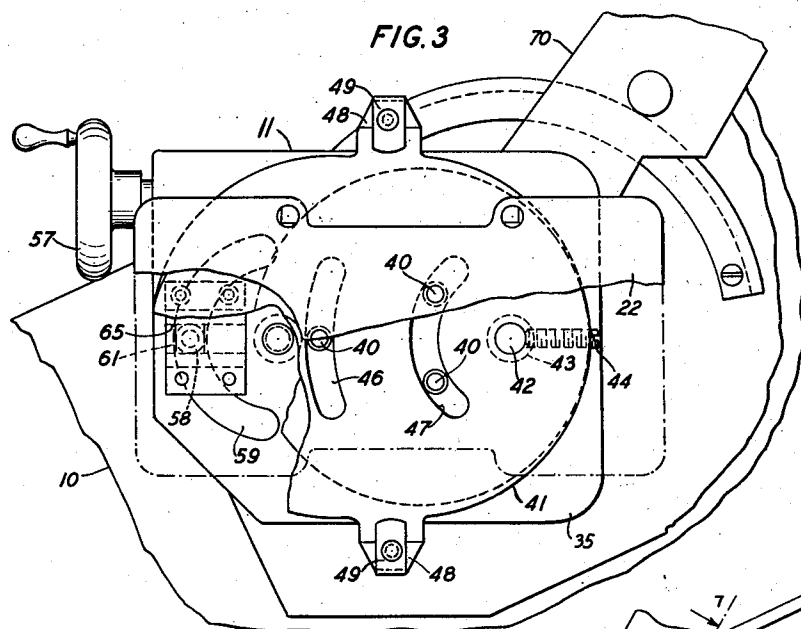
J. C. LULEY

2,394,622

ORIENTING DEVICE

Filed Oct. 19, 1943

4 Sheets-Sheet 3



INVENTOR
J. C. LULEY
BY
E. R. Nowlan
ATTORNEY

Feb. 12, 1946.

J. C. LULEY

2,394,622

ORIENTING DEVICE

Filed Oct. 19, 1943

4 Sheets-Sheet 4

FIG. 6

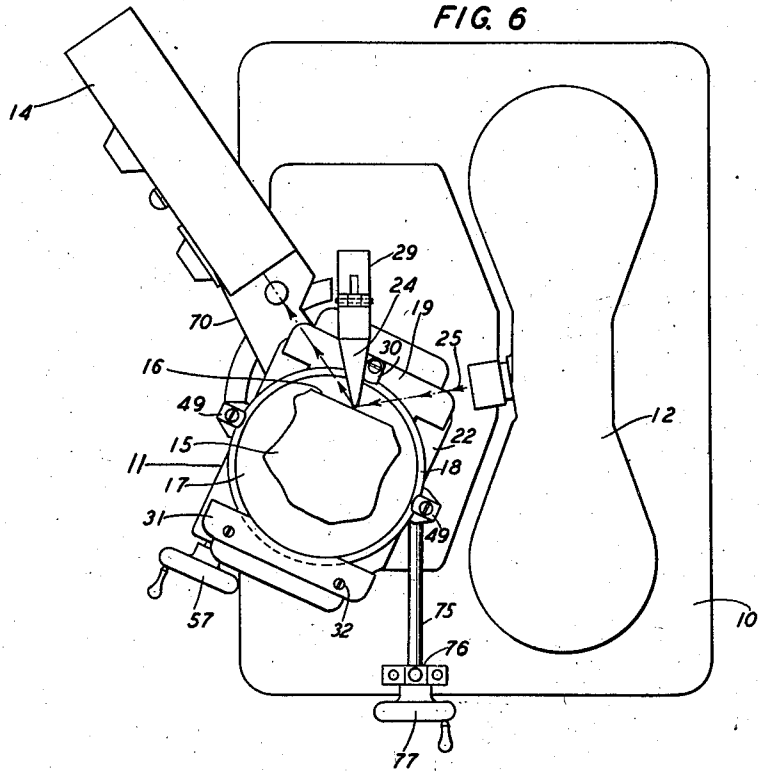
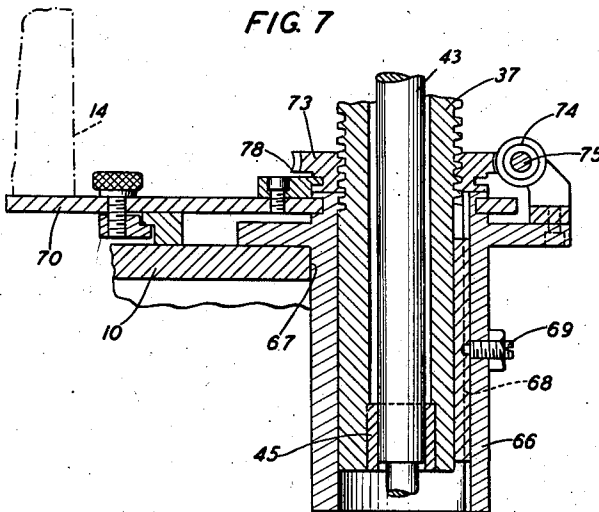


FIG. 7



INVENTOR
J. C. LULEY

BY

E. R. Nowlan

ATTORNEY

UNITED STATES PATENT OFFICE

2,394,622

ORIENTING DEVICE

John C. Luley, Teaneck, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application October 19, 1943, Serial No. 506,906

12 Claims. (Cl. 250—52)

This invention relates to orienting devices, and more particularly to devices for orienting quartz crystals in determining certain axes thereof.

In the processing of quartz crystals to obtain therefrom quartz crystal plates for use in electrical units, it is important to determine the location of certain of the existing axes in the quartz crystals to determine the relative location of a crystal with a saw which is to cut the crystal into sections.

An object of the invention is to provide an orienting device which is simple in structure, easily operable and highly efficient in orienting an article relative to a given point.

With this and other objects in view, the invention comprises an orienting device having a stationary table for receiving a base plate upon which a mounting element for an article is disposed for rotation, mechanism for moving the mounting element with the article about a fixed point relative to the base plate, and clamps on the latter for clamping the mounting element at a selected position thereon.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a top plan view of the device shown in combination with an X-ray unit and unit sensitive to X-rays;

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken substantially along the line 3—3 of Fig. 2, portions thereof being broken away;

Fig. 4 is a fragmentary sectional view taken substantially along the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary sectional view taken substantially along the line 5—5 of Fig. 2;

Fig. 6 is a schematic top plan view of the device shown in conjunction with the X-ray unit and the unit sensitive to X-rays;

Fig. 7 is a fragmentary sectional view taken substantially along the line 7—7 of Fig. 4, and

Fig. 8 is a top plan view of the attaching element and the table supporting it.

Referring now to the drawings, attention is first directed to Fig. 6, which illustrates a table 10 upon which an orienting device, indicated generally at 11, is mounted in a desired position relative to an X-ray unit 12 and a unit 14 sensitive to X-rays, the latter being commercially known as an ionization chamber. Quartz crystals, one of which is indicated at 15, are naturally hexagonal in cross-section, providing six natural

sides if, during the obtaining of the crystals, such as by mining or other methods, the crystals are not broken. The crystal shown in Fig. 6 has certain of its natural sides broken away, natural side 16 being employed in the present instance to determine what is meant as the X or electric axis of the crystal. If the crystal is broken so that there exists no natural side or face, a flat surface is ground on a portion of the crystal and from this surface the axis is determined.

The crystal 15 is cemented or secured in any other suitable manner upon a circular mounting plate provided with an annular flange 18 at its periphery. In addition to the mounting plate, an H-shaped base plate or attaching element 19, shown more clearly in Fig. 8, is employed in attaching the crystal and its mounting plate upon the work support of a cutting apparatus (not shown) for use in cutting the crystal into sections. The H-shaped element 19 is formed to be mounted in a given position upon the work support of the cutting apparatus. Therefore, to assure the mounting of the crystal with the selected axis thereof at a given angle with respect to the saw or cutting element, it is necessary to secure the mounting plate 17 upon the element 19 with the said axis extending in a given direction. Therefore, the orienting device 11, as illustrated in Fig. 6, is mounted with respect to the units 12 and 14 so this result may be accomplished.

A table 22 is provided with a plurality of locating elements 23 having flat surfaces, as shown, for the location of the element 19 therebetween, as illustrated in Fig. 8, and for the movement of the element toward a locating finger 24. The extreme end of the finger 24 when in the locating position shown in Figs. 1, 2 and 6, is disposed at a point in the path of an X-ray beam, indicated at 25, projecting from the unit 12. In determining the electric axis of the crystal, it is important that a given point in the natural side or face of the crystal be moved about an axis where the X-ray beam meets this surface. This is the purpose of the locating finger, to locate a given point of the surface of the crystal where it meets the X-ray beam. By orienting the crystal until the beam 25 is reflected at an angle for most efficient registration with the unit 14, the crystal is moved to locate the electric axis at a given position relative to the element 19.

The locating finger 24 is pivotally supported, at 28, upon a bracket 29, the latter being mounted upon the table 10. Through the aid of the pivot 28, the finger may be moved out of engagement with the crystal after it has served its purpose.

Clamps 33 and 31 are disposed upon the element 19 and formed, when their retaining screws 32 are loosened sufficiently to permit rotation of the mounting plate 17 thereon but to maintain general relative positions of the mounting plate and element. The annular flange 18 of the mounting plate rides in a groove 33 of the clamp 31 during rotation of the mounting plate relative to the element.

A fixed member 35, parallel with the table 22 and spaced therefrom, as shown in Fig. 2, has an embossed portion 36 integral therewith and apertured to receive the upper end of a threaded support 37 upon which the member is mounted and secured against rotation relative thereto, as at 38. The table 22 is supported by the member 35 through the aid of connecting pins or elements 40, having enlarged central portions providing shoulders respectively engaging the member 35 and the table to space them a given distance apart. An oscillating element 41, interposed between the member 35 and the table 22, is fixed to a threaded end 42 of a shaft 43, as at 44, the shaft being disposed concentrically in the threaded support 37 and rotatably journaled in bearings 45 therein. Elongate arcuate apertures 46 and 47 are provided in the oscillating element 41 adjacent the pins 40, to condition the element 41 for movement relative to the pins as well as the member 35 and the table 22. At diametrically opposed positions, L-shaped integral portions 48 of the element 41 are provided with clamps 49 for use in clamping the mounting plate 17, as shown in Figs. 1 and 6, to the element. Means is provided to oscillate or orient the element 41 about the axis of the shaft 43 which intersects the point of the crystal positioned adjacent the locating finger 24. Thus through the aid of the portions 43 and the clamps 49, these portions of the element 41 extend around the table 22 and grip the mounting plate 17 so as to move the mounting plate with the crystal relative to the table 22 and the element 19.

The moving means includes a worm gear 52 rotatably journaled on a spindle 53, the latter being supported by the member 35 as shown in Fig. 2. A worm 54, mounted upon a shaft 55, interengages the worm gear 52 (Fig. 4). The shaft 55 is journaled in suitable bearings, indicated at 56, and has a hand wheel 57 mounted on the outer end thereof through the aid of which the shaft may be rotated. A vertically projecting pin 58, carried by the worm gear 52, as illustrated in Figs. 2 and 5, extends through an arcuate aperture 59 (Figs. 2, 3, 4 and 5), an upper reduced end 60 of the pin being journaled in a bearing block 61. The aperture 59 is in the member 35, the radial center thereof being at the center of the spindle 53. A bracket 62 is disposed in a cut-away portion 63 in the element 41 and is secured in place as at 64. The bearing block 61 is square in cross-section, as shown in Fig. 3, and is disposed for longitudinal movement in a recess or groove 65 in the bracket, the recess extending the full width thereof.

Returning now to Figs. 2 and 7, it will be noted that a tubular housing 66 is provided for the threaded support 37 and is fixedly mounted in an aperture 67 in the table 10. The threaded portion of the support 37 extends above the housing, the portion of the support within the housing having a smooth outer surface adapting the support for vertical movement in the housing. A vertical slot 68 is formed in the lower portion of the support 37 to cooperate with a reduced end of

a screw 69, carried by the housing 66, to permit vertical movement of the support, but to maintain the latter together with the table 22 and member 35 against rotation (Fig. 7). A base plate 70, having a yoke-like end 71 receivable in an annular groove 72 of the upper portion of the housing 66, serves to support the unit 14 at a given point with respect to the center line of the shaft 43. A worm gear 73, disposed upon the threaded portion of the support 37 and having internal threads engaging therewith, presses upon the upper end of the housing 66 and serves as a part of the means to elevate the main structure of the device to locate the article vertically relative to the X-ray beam 25. A worm 74 (Figs. 4 and 7) is fixedly mounted upon a shaft 75 and interengages the worm gear 73. The shaft 75 is journaled in suitable bearings 76 and has a hand wheel 77 mounted upon the outer end thereof, as illustrated in Fig. 6. An interfitted retaining member 78, carried by the base plate 70, serves to hold the worm gear 73 against vertical movement.

Upon considering the operation of the orienting device in combination with the X-ray unit 12 and the ionization chamber or unit 14, let it be assumed that the crystal 15 has been selected and suitably mounted upon the mounting plate 17. The mounting plate 17 with the crystal is then disposed upon the H-shaped element 19 and loosely held thereon against accidental displacement but for relative rotation through the aid of clamps 33 and 31. This assembly is then placed upon the table 22 between the elements 23, as shown in Fig. 8. With the locating finger 24 in the position shown, the crystal with the mounting plate and element 19 may be moved in a fixed path governed by the elements 23 until the selected natural surface of the crystal engages the locating finger. At this time the mounting plate 17 is secured to the oscillating element 41 through the aid of clamps 49, and after the finger 24 is moved out of engagement with the crystal, the device is in readiness for orientation of the crystal to move the point which previously engaged the finger about a vertical axis intersecting the point of the reflection of the X-ray beam 25 until the beam is caused to reflect into the ionization chamber, as illustrated in Fig. 6. At this time the location of the X or electric axis of the crystal will be known and the crystal will be located with respect to the longitudinal center line of the element 19. To produce piezoelectric plates with the desired characteristics, it is important that the original cuts in the crystal, to produce the slabs from which the plates are finally cut, extend at a given angle from the X or electric axis.

The crystal is oriented through actuation of the hand wheel 57, to cause rotation of the worm 54 to move the worm gear 52 in either direction about its spindle 53, to cause the pin 58, through its connection with the element 41, to move the element, the mounting plate 17 and the crystal about the axis of the shaft 43. In so doing, the selected point of the crystal is moved about the same axis.

If during the preparation of the device the point of the crystal desired for use in determining the axis of the crystal is not in alignment with the finger 24, the entire structure may be raised or lowered through the action of hand wheel 77, to actuate the worm gear 73 and the worm 74 to effect upward or downward move-

ment of the mechanism carried by the threaded support 37.

After the desired axis has been located with respect to the center line of the element 19, the maximum reflection being registered in the ionization chamber, the clamps 30 and 31 of the element 19 may be tightened in place on the flange 18 of the mounting plate 17, after which the clamps 49 may be released and moved to one side by rotation about their screws, to free the assembly including the crystal, the mounting plate and the element 19 so that they may be transferred to the apparatus for cutting the crystal.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, means to support the base plate with the mounting plate and crystal in a position whereby a selected portion of a surface of the crystal engaging the said end of the locating element will be at the point of reflection of the X-ray beam, and means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal.

2. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, means to support the base plate with the mounting plate and crystal in a position whereby a selected portion of a surface of the crystal engaging the said end of the locating element will be at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to secure the mounting plate with the crystal at the oriented position to the base plate.

3. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, a table to support the base plate with the mounting plate and crystal thereon, means on the table to guide the base plate for movement in a given path with the mounting plate and crystal to position a selected portion of a surface of the crystal in engagement with the end of the locating element at the point of reflection of the X-ray beam, and means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal.

4. A device for orienting a quartz crystal with

a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, a table to support the base plate with the mounting plate and crystal thereon, means on the table to guide the base plate for movement in a given path with the mounting plate and crystal to position a selected portion of a surface of the crystal in engagement with the end of the locating element at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to secure the mounting plate with the crystal at the oriented position to the base plate.

5. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, means to support the base plate with the mounting plate and crystal in a position whereby a selected portion of a surface of the crystal engaging the said end of the locating element will be at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to support the locating element for movement of the said end thereof into and out of locating position.

6. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, a table to support the base plate with the mounting plate and crystal thereon, means on the table to guide the base plate for movement in a given path with the mounting plate and crystal to position a selected portion of a surface of the crystal in engagement with the end of the locating element at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to move the table longitudinally of the said axis to position the selected portion of the crystal in general alignment with the end of the locating element.

7. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, means to move the base plate with the mounting plate and crystal in a plane substantially parallel with the X-ray beam to position a surface of the crystal in engagement with the locating element, means to move the base plate with the mounting plate and crystal in a direction substantially at right angles to the X-ray beam to position a given point of the surface of the crystal in engagement with the end of the locating element, and means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until

the maximum reflection of the X-ray beam is received by the unit from the selected point of the crystal.

8. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, a table to support the base plate with the mounting plate and crystal thereon, means on the table to guide the base plate for movement in a given path with the mounting plate and crystal to position a selected portion of a surface of the crystal in engagement with the end of the locating element at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to hold the table against rotary movement with the mounting plate and crystal.

9. A device for orienting a quartz crystal with a mounting plate therefor on a base plate relative to an X-ray beam and a unit sensitive to the X-ray beam, the device comprising a locating element having an end positioned to lie in the X-ray beam, a table to support the base plate with the mounting plate and crystal thereon, means on the table to guide the base plate for movement in a given path with the mounting plate and crystal to position a selected portion of a surface of the crystal in engagement with the end of the locating element at the point of reflection of the X-ray beam, means to move the mounting plate with the crystal relative to the base plate about an axis intersecting the point of reflection until the maximum reflection of the X-ray beam is received by the unit from the selected portion of the crystal, and means to hold the table against rotary movement with the mounting plate and crystal, the said guide means on the table holding the base plate against rotary movement with the mounting plate and crystal.

10. A device for locating a given axis in a quartz crystal, secured to a mounting plate, in a predetermined direction with respect to a base plate, the device comprising an X-ray unit to project an X-ray beam in a given path, a unit sensitive to the X-ray beam disposed at a given angle with respect to the said path, a locating

element having an end positioned to lie in the X-ray beam, means to move the base plate with the mounting plate and crystal to position a given point of a surface of the crystal in engagement with the end of the locating element, and means to orient the mounting plate with the crystal about the said point of the crystal until the x-ray beam is reflected into the X-ray beam sensitive unit and the said given axis of the crystal is extending in the predetermined direction.

11. A device for locating a given axis in a quartz crystal, secured to a mounting plate, in a predetermined direction with respect to a base plate, the device comprising an X-ray unit to project an X-ray beam in a given path, a unit sensitive to the X-ray beam disposed at a given angle with respect to the said path, a locating element having an end positioned to lie in the X-ray beam, means to move the base plate with the mounting plate and crystal to position a given point of a surface of the crystal in engagement with the end of the locating element, means to orient the mounting plate with the crystal about the said point of the crystal until the X-ray beam is reflected into the X-ray beam sensitive unit and the said given axis of the crystal is extending in the predetermined direction, and a support for the locating element conditioning it for movement into and out of locating position.

12. A device for locating a given axis in a quartz crystal, secured to a mounting plate, in a predetermined direction with respect to a base plate, the device comprising an X-ray unit to project an X-ray beam in a given path, a unit sensitive to the X-ray beam disposed at a given angle with respect to the said path, a locating element having an end positioned to lie in the X-ray beam, means to move the base plate with the mounting plate and crystal to position a given point of a surface of the crystal in engagement with the end of the locating element means to orient the mounting plate with the crystal about the said point of the crystal until the X-ray beam is reflected into the X-ray beam sensitive unit and the said given axis of the crystal is extending in the predetermined direction, and means to vary the position of the base plate relative to the units to present a selected one of various points of the crystal in the said path.

JOHN C. LULEY.