April 23, 1946. C. C. McCAIN 2,399,052

APPARATUS FOR HANDLING ARTICLES

Filed May 13, 1943 2 Sheets-Sheet 1

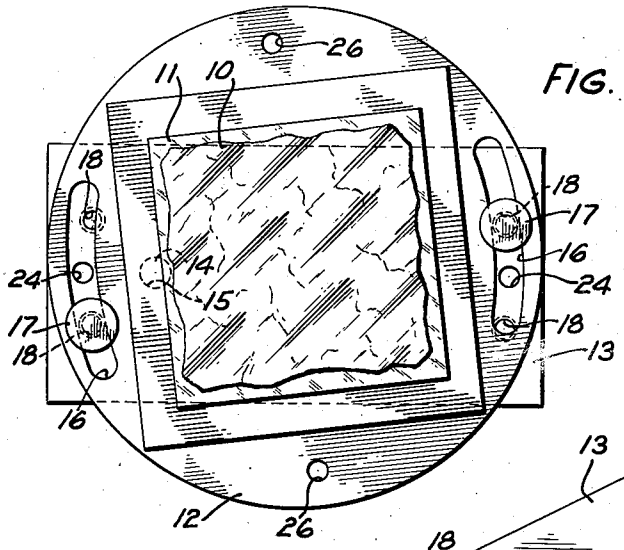


FIG. 1

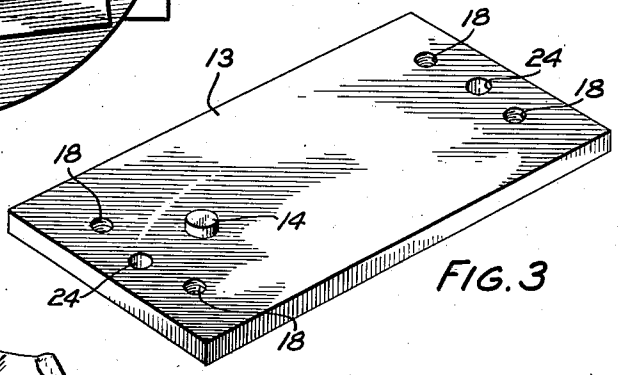


FIG. 3

FIG. 2

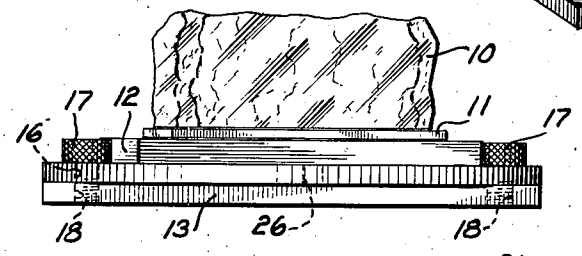
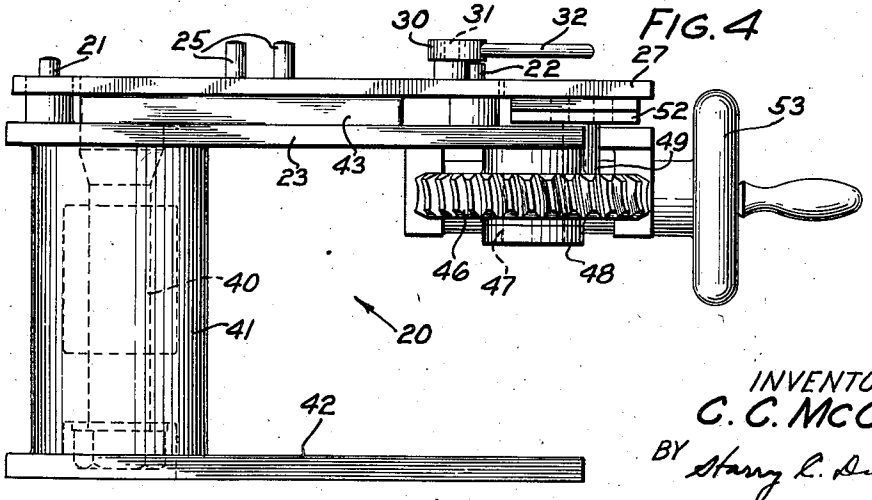


FIG. 4



INVENTOR
C. C. McCAIN
BY Harry R. Duft
ATTORNEY

April 23, 1946. C. C. McCAIN 2,399,052

APPARATUS FOR HANDLING ARTICLES

Filed May 13, 1943 2 Sheets-Sheet 2

FIG. 5

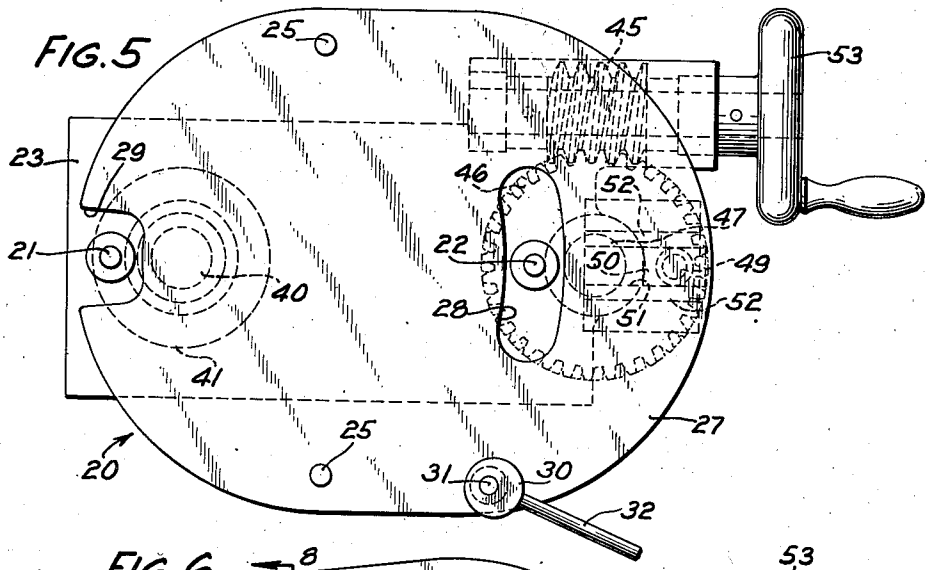


FIG. 6

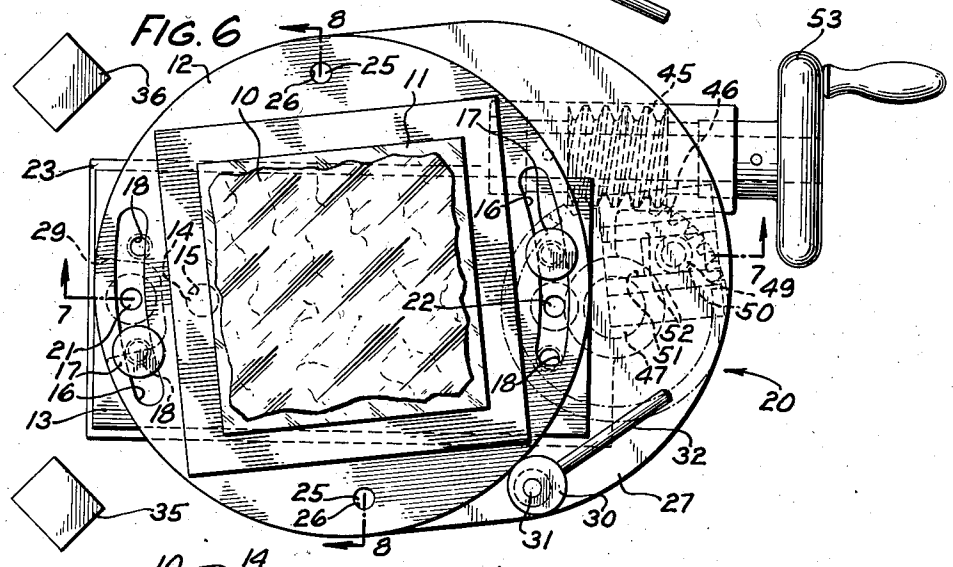


FIG. 7

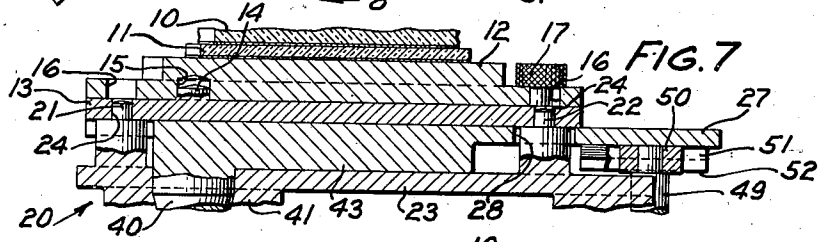
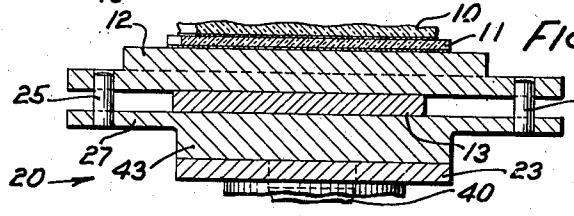


FIG. 8



INVENTOR
C. C. McCAIN
BY Harry C. Dunft
ATTORNEY

Patented Apr. 23, 1946

2,399,052

UNITED STATES PATENT OFFICE

2,399,052

APPARATUS FOR HANDLING ARTICLES

Cecil C. McCain, Glen Ellyn, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application May 13, 1943, Serial No. 486,859

9 Claims. (Cl. 51—277)

This invention relates to an apparatus for article handling and more particularly to an apparatus for aligning a quartz crystal with a support.

In one stage in the manufacture of quartz crystals, such as used for frequency control devices in electronic communication equipment, a rough block of quartz may be sawed into slabs, the block being cut at a certain angle to each of its several axes. Heretofore, one practice has been to determine one of these axes, to mark the crystal accordingly, and then to cut the crystal parallel to or at a predetermined angle to that mark. The extremely high degree of accuracy required to obtain satisfactory crystals makes such a procedure very slow and difficult.

Objects of the present invention are to provide an efficient and effective apparatus for article handling.

In accordance with one embodiment of this invention, an apparatus may be provided in which a quartz crystal, cemented to a mounting plate, may be aligned with respect to an X-ray beam to adjust the position of the mounted crystal relatively to a base plate associated with the mounting plate, while the base plate is held motionless by fixed aligning pins on the apparatus. Both plates are then locked together in adjusted position and transferred to a cutting apparatus which has aligning pins corresponding to those on the aligning apparatus, which also engage the base plate.

Other objects and advantages of the present invention will be apparent from the following detailed description taken in conjunction with the drawings, wherein

Fig. 1 is a plan view of a crystal block mounted on a plate assembly in accordance with this invention;

Fig. 2 is a side view of the same;

Fig. 3 is a perspective view of a base plate used with this assembly;

Fig. 4 is a side elevation of the aligning apparatus used with this invention;

Fig. 5 is a plan view of the apparatus shown in Fig. 4;

Fig. 6 is a view similar to Fig. 5 showing, however, the assembly of Fig. 1 mounted on the apparatus;

Fig. 7 is a sectional view along the line 7—7 of Fig. 6; and

Fig. 8 is a sectional view along the line 8—8 of Fig. 6.

Referring now to the drawings and particularly to Figs. 1 and 2, a quartz crystal 10 is there illustrated cemented to a glass plate 11 which is in turn cemented on a mounting plate 12. During the sawing operation, the saw must cut beyond the lower edge of the quartz and, thus, by positioning the glass plate between the quartz and the mounting, the glass being relatively easy to cut, damage to the saw or to the mounting plate is avoided. The approximate position of one axis of the crystal may be determined in advance by a suitable means and the crystal positioned on the plate 12 with reference to this axis in order to reduce the subsequent adjustment required in the aligning operation to be described herein.

After the crystal 10 and glass supporting plate 11 have been cemented to the mounting plate 12, a rectangular base plate 13, shown in perspective in Fig. 3, is positioned beneath the mounting plate 12 and in contact therewith. An upwardly projecting cylindrically shaped lug 14, integrally formed with the upper side of the plate 13, then extends into and engages a cylindrically shaped recess 15 formed in the lower side of the mounting plate 12, as shown in Fig. 7. In order to hold the aligning plate and mounting plate together, a pair of arcuate slots 16 are formed on opposite sides of the mounting plate 12 and bolts 17 are positioned therein and threaded into threaded apertures 18 formed in the base plate 13 to lock the plates 12 and 13 together. It will be noted that four apertures 18 are shown while only two bolts 17 are shown. In practice, because the mounted plate will be moved with respect to the base plate, only one aperture 18 at either end of the base plate will be available at a time. By forming two apertures 18 at either end, the necessary length of the arcuate slots 16 is reduced.

When the plates have been assembled, as described, the assembly is then positioned on an aligning apparatus designated generally as 20 and shown in Figs. 4 through 8. A pair of upwardly extending fixed pins 21 and 22, mounted on a fixed horizontal shelf 23, then engage a pair of apertures 24 formed in the rectangular base plate 13, while a second pair of pins 25 extend through apertures 26 formed in the mounting plate 12, the pins 25 being fixed to a rotatable platform 27 of the apparatus 20. An arcuate slot 28 is formed in the platform 27 to permit the right fixed pin 22 to extend therethrough, while a portion 29 of the left edge of the platform is recessed to permit the left fixed pin 21 to extend therethrough. A cam 30 fixed to a shaft 31, which is mounted near the edge of the platform 27, may be rotated by an arm 32 to engage the edge of the mounting plate 12 and to lock it rig-

idly in position on the platform 27. Since the platform pins 25 fit closely into the apertures 26 formed in the plate 12, substantially no movement of the mounting plate occurs with respect to the platform when the cam 30 engages the edge of the mounting plate. However, the cam insures rigidity during the aligning operation and uniformity in the position of the mounting plates with respect to the pins and platform 27.

The next step is to determine the position of an axis of the crystal block with reference to which the crystal is later to be cut. With the present apparatus, the "X" or electrical axis is employed as the reference axis. By directing an X-ray beam toward an end face of the crystal, it has been found that if a certain angle of incidence of the beam with respect to what may be termed an X-ray plane, present in all quartz crystals, is employed, the beam will be reflected from this plane without substantial impairment. This X-ray plane is known to lie in a definite relation to the electrical axis of the crystal. Hence, by determining the position of the X-ray plane, the precise relative position of the electrical axis may be computed. For example, if the X-ray plane lies at an angle of 25° from the electrical axis, it will be apparent that by cutting at an angle of 25° to this plane, a crystal block may be cut parallel to its electrical axis.

In the present apparatus, a source 35 of X-rays having collimating means associated therewith for projecting parallel rays therefrom is positioned adjacent the left end of the fixture 20, its position relative thereto being precisely determined. For example, if the required angle of incidence is 45°, the source 35 will be positioned so that the rays projected therefrom will pass through an imaginary line extending parallel to the pins 21 and 22, at an angle of 45°. When a quartz crystal is in position on the apparatus and its X-ray plane is properly aligned with respect to the X-ray beam, the beam will be reflected with maximum intensity to a registering device 36, also positioned adjacent the left end of the fixture 20, but on an imaginary line which intersects the projected X-ray beam at approximately 90°. Since the registering device 36 indicates the intensity of the reflected X-ray beam, the angle of reception is not necessarily critical, since, unless the crystal is closely aligned with respect to the X-ray beam, the reflected beam will be of relatively low intensity.

Alignment of the crystal with respect to the X-ray beam is effected by rotating the platform 27, the pins 25 causing the plate 12 to rotate therewith, while the pins 21 and 22, being fixed, prevent the base plate 13 from rotating. The platform 27 is rotatably supported on a shaft 40 which is journalled in a vertically positioned housing 41, the housing 41 being mounted on a member 42 which serves as a base for the apparatus. A raised portion 43, integrally formed on the lower side of the platform 27, rests on the horizontal shelf 23 which is fixed rigidly to the housing 41, the portion 43 slidably engaging the shelf 23 and, thus, cooperating with the shaft 40 in supporting the pivotable platform 27.

Rotation of the platform 27 is accomplished by rotating a worm gear 45 which engages a spur gear 46 mounted on a shaft 47 journalled in a housing 48 which is fixed to the lower side of the shelf 23 and at the right end thereof. A lug 49 is mounted on the upper side of the gear 46 near its periphery and engages a member 50 which is slidably positioned in a channel 51 formed by two parallel, downwardly extending, spaced walls 52 fixed to the lower side of the platform 27. As the gear 46 is rotated, the lug 49 causes the platform 27 to pivot on the shaft 40. A crank 53 keyed to the worm gear 45 facilitates rotation thereof.

Since the mounting plate 12 is engaged by the pins 25, which are mounted on the platform 27, the plate will be pivoted as the platform is pivoted. Furthermore, the upwardly extending lug 14 formed in the plate 13 is positioned on the plate 13 so that when the plate 13 is assembled on the apparatus 20 with the crystal mounting plate 12 attached thereto, the axis of rotation about which the mounting plate 12 is pivoted with respect to the base plate 13 will coincide with the axis of rotation of the platform 27. It will be understood that the assembly bolts 17 are removed during the aligning operation.

By observing the registering device 36 as the crystal is rotated by rotating the platform 27, while an X-ray beam is directed toward the crystal from the source 35, the exact position of the X-ray plane of the crystal may be determined. When this has been done, the bolts 17 which lock the plate 12 to the base 13 are tightened, and the assembly is removed from the fixture. The locked assembly may then be transferred to a cutting apparatus, not shown, having aligning pins corresponding to the aligning pins 21 and 22 which will engage the apertures 24 formed in the base plate 13. The cutting tool may be adjusted then to cut at any desired angle. For example, if the crystal is to be cut at an angle of 35° from its electrical axis, since the relative position of the electrical axis with respect to the X-ray plane is known, the angle of cut may be easily computed.

What is claimed is:

1. An apparatus for aligning a quartz crystal cemented to a mounting plate with respect to a base plate on which said mounting plate is mounted comprising fixed means for supporting the base plate in a fixed position, connector means for engaging the mounting plate, a fixed platform for supporting said fixed means, a pivotable platform for supporting said connector means in position to engage the connector means with the mounting plate, and means for pivoting said latter platform to adjust said mounting plate relatively to said base plates through the action of said connector means for aligning said crystal with respect to said base plate.

2. In an apparatus for aligning a quartz crystal cemented to a mounting plate with respect to a base plate, a platform for supporting said mounting plate and said base plate in superposed relation, a rotatable shaft for supporting said platform, said platform being supported thereon so as to be pivotable in a plane substantially perpendicular to the axis of rotation of said shaft, means on said platform for connecting said mounting plate thereto for pivotal movement therewith, a fixed platform, means on said fixed platform for positioning said base plate in a fixed position, and means for pivoting said pivotable platform to adjust said mounting plate relatively to said base plate to align said crystal with respect to said base plate.

3. In an apparatus for aligning a quartz crystal cemented to a mounting plate with respect to a base plate, a platform, a rotatable shaft for supporting said platform, said platform being supported thereon so as to be pivotable in a plane substantially perpendicular to the axis of rota-

tion of said shaft, means on said platform for engaging said mounting plate, a fixed platform, means on said fixed platform for engaging said base plate in a predetermined relation to said fixed platform, a lug formed on the upper side of said base plate and positioned so that when said base plate is assembled on said fixed platform, the center of said lug coincides with the axis of rotation of said rotatable shaft, said mounting plate having a recess formed therein in which said lug is receivable, and means for causing said mounting plate to be pivoted with respect to said base plate, said mounting plate pivoting about an axis coinciding with the axis of rotation of said rotatable shaft.

4. In an apparatus for aligning a quartz crystal cemented to a mounting plate with respect to a base plate, a platform, a rotatable shaft for supporting said platform, said platform being supported thereon so as to be pivotable in a plane substantially perpendicular to the axis of rotation of said shaft, means on said platform for engaging said mounting plate, a fixed platform, means on said fixed platform for engaging said base plate in a predetermined relation, a lug formed on the upper side of said base plate and positioned so that when said base plate is assembled on said fixed platform, the center of said lug coincides with the axis of rotation of said rotatable shaft, said mounting plate having a recess formed therein in which said lug is receivable, means for causing said mounting plate to be pivoted with respect to said base plate, said mounting plate pivoting about an axis coinciding with the axis of rotation of said rotatable shaft, and means for clamping said mounting plate to said base plate in aligned relation.

5. A crystal mounting assembly comprising a positioning plate receivable in a predetermined relation in a crystal working apparatus and having a pivot pin mounted thereon near one end thereof, a mounting plate pivotally mounted on said mounting plate and having a recess noncentrally located therein for receiving said pivot pin, said mounting plate having a flat surface for supporting a crystal in a central location thereon and with one of its sides substantially in alignment with said pivot, and means carried by said positioning plate for securing said plates together in adjusted relation.

6. A crystal mounting assembly comprising a positioning plate receivable in a predetermined relation in a crystal working apparatus, a mounting plate adjustably supported on said positioning plate and having a flat surface thereon for supporting a crystal fixed thereon in a central position, pivot means interconnecting said plates and located in a position removed from the center of said plates and providing an axis perpendicular to said crystal supporting surface about which axis said plates may be relatively adjusted to align the crystal with respect to said positioning plate, and means carried by one of said plates for securing said plates together in adjusted position.

7. An apparatus for aligning an article on its mounting comprising a mounting plate having said article secured thereto, a base plate for adjustably supporting said mounting plate, pivot means interconnecting said plates and providing an axis about which said plates are relatively angularly adjustable, a fixed platform, means on said platform for supporting said base plate in a fixed position, a movable member pivotally mounted on said platform to turn about an axis in alignment with said pivot means interconnecting said base and mounting plates, means on said movable member for connecting said mounting plate to said movable member for movement therewith, means for rotating said movable member to move said mounting plate to align said article with respect to said base plate, and means mounted on said base plate for securing said plates together in adjusted position.

8. An apparatus for aligning a crystal on its mounting comprising a stationary member having spaced supporting and positioning elements thereon, a movable member pivotally mounted on said stationary member and having spaced connector elements thereon, a base plate supported in a fixed position on said supporting and positioning element of said stationary member, a mounting plate superposed on said base plate and having a pivotal connection therewith about which said plates are relatively adjustable, the axis of rotation of said plates being in alignment with the axis of rotation of said movable member, said mounting plate having a connecting engagement with the connector elements of said movable member, means for moving said movable member about its axis of rotation for moving said mounting plate and aligning said crystal with respect to said base plate, and means carried by one of said plates for securing said plates together in aligned position.

9. An apparatus for aligning a crystal on its mounting comprising a stationary member having spaced positioning elements thereon, a movable supporting member pivotally mounted on said stationary member and having spaced connector elements thereon, a base plate supported on said movable supporting member and engaging said positioning elements on said stationary member and being maintained in a fixed relation thereto during the aligning operation, a mounting plate superposed on said base plate and having a pivotal connection therewith about which said plates are relatively adjustable, said mounting plate projecting beyond said base plate and having a connecting engagement with said connector elements of said movable member, means for moving said movable member about its axis of rotation for moving said mounting plate and aligning said crystal with respect to said base plate, and means carried by said base plate for securing said plates together in aligned position.

CECIL C. McCAIN.