March 23, 1943. G. C. HUNT 2,314,787

GRINDING MACHINE

Filed Dec. 6, 1941

Fig. 1

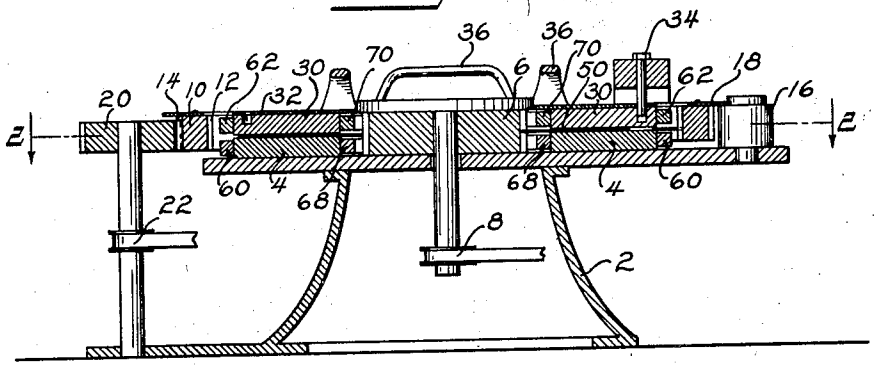
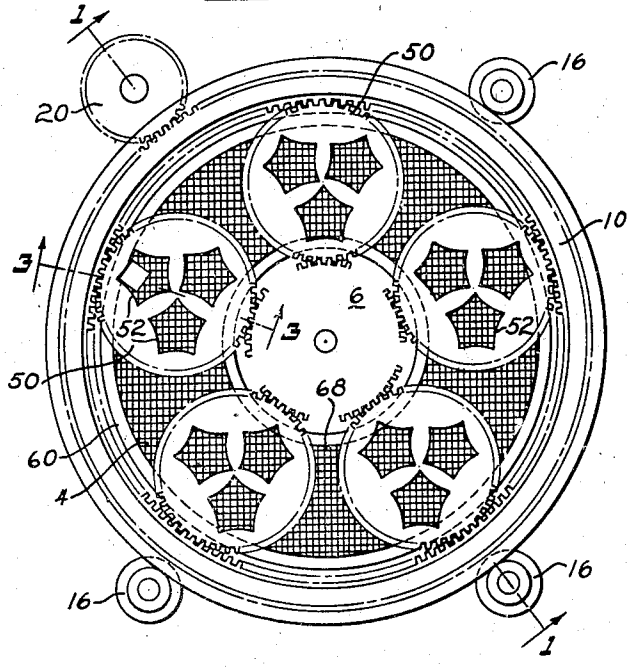


Fig. 2



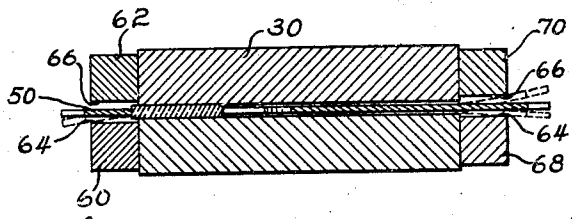


Fig. 3

Inventor

Grover C. Hunt

By Samuel Reinemer Jr.

Attorney

Patented Mar. 23, 1943 2,314,787

UNITED STATES PATENT OFFICE

2,314,787

GRINDING MACHINE

Grover C. Hunt, Carlisle, Pa.

Application December 6, 1941, Serial No. 422,001

6 Claims. (Cl. 51—161)

This invention relates to grinding machines of the type generally known as lapping machines and, more specifically, relates to lapping machines which are particularly intended for the grinding of polygonal, relatively thin devices or articles such as piezo-electric crystals.

It has heretofore been proposed, and is now known, to provide a lapping machine in which externally geared work holders are disposed between two superposed abrasive discs and are geared to a rotating pinion which is located centrally of the discs and to a fixed outer ring gear which is concentric with the pinion, whereby rotation of either the pinion or the ring gear will cause the work holders to describe a planetary movement about the pinion and, simultaneously, to rotate about their respective axes. The articles carried by the work holders are thus caused to move in either an epicycloidal or a hypocycloidal path across the faces of the discs. It is also known to so proportion the dimensions of the discs and the work holders that during their travel the articles carried by the work holders are caused to pass beyond the inner and outer peripheral edges of the discs, thereby causing travel of the articles over the entire surfaces of the discs.

I have found that in the operation of machines such as that described the movement of part of the work piece beyond the inner or outer peripheral edge of the discs permits the work holder, which also extends beyond the edge of the discs, to be deformed to a position below or above the lower or upper surface, respectively, of the work piece, whereby the edge of the holder may move below the lower surface or above the upper surface of the work piece upon further movement of the holder in its planetary and rotary travel. This has been found to occur particularlly in the grinding of thin articles, such as piezo-electric crystals, in which a relatively thin and flexible holder is employed. It has been found that such a disarrangement of the holder and work piece results in the ruining of the holder and the work piece.

It is therefore an object of the invention to provide means, in a machine of the type described and in which the work pieces being ground move radially beyond the inner and outer peripheries of the discs, to prevent the work holders from engaging or passing above or below the upper or lower surfaces of the work pieces.

It is also an object of the invention to provide a machine which is particularly useful and advantageous in the difficult and exacting work of grinding piezo-electric crystals.

Means for effecting these objects, as well as other objects of the invention, will be made apparent by the following description and the annexed drawing, it being understood that the description and drawing are only illustrative of the invention, for the limits of which reference must be had to the appended claims.

Referring to the drawing, in which the same reference numerals and letters refer to like parts,

Fig. 1 is a vertical sectional view of a machine embodying this invention, taken on line 1—1 of Fig. 2;

Fig. 2 is a plan view of the machine of Fig. 1, taken on the line 2—2 of Fig. 1, and

Fig. 3 is a view of a part of the machine of Figs. 1 and 2, taken on the line 3—3 of Fig. 2.

A machine embodying the features of my invention is disclosed in the various figures of the drawing and comprises a base or standard 2 which supports a lower abrasive disc 4 which is fixed against movement, as by rigid attachment to the base. The lower disc is provided with a preferably circular central opening within which is disposed a pinion gear 6 which may be driven by any suitable means such as the pulley and belt 8. The gear 6 extends substantially above the upper surface of the lower disc. Concentric with pinion 6 and surrounding the disc 4 is a ring gear 10 having teeth 12, 14 on its internal and external faces respectively. The ring gear 10 is mounted for rotation and is supported by bearings 16 which engage the lower surface of an annular flange or cover 18 which is connected to the upper surface of the ring gear. A pinion gear 20 engages the external teeth 14 of the ring gear and, in order to rotate the ring gear, may be driven by suitable means such as the pulley and belt arrangement 22. An upper abrasive disc 30, which is substantially identical with the lower disc is attached to a cover 32 and is adapted to be received within the ring gear, whereby the abrasive faces of the two discs are opposed and will be in engagement with each other unless the crystals or the work holding means which are described hereinafter are interposed between them. The cover 32 and the upper disc are provided with openings within which a fixed pin, such as 34, may be received in order to prevent rotary or other movement of the upper disc. The cover may also be provided with handles 36 whereby it and the attached upper disc may be lifted. The upper disc and the cover therefor are preferably provided with a central opening

which receives the upper portion of the pinion gear 6. Between the two abrasive discs are provided circular work holders 50, each of which is provided with gear teeth on its external periphery and is of such size that the gear teeth thereon engage those on the pinion gear 6 and the internal teeth 12 of the ring gear 10. Openings 52 are provided in each work holder within each of which a crystal is received and held during movement of the work holders.

The discs and the work holders are so proportioned that crystals carried by the work holders are caused to move beyond the inner and outer peripheries of the discs during their travel. Means are provided by the invention for preventing that portion of the holder which extends inwardly or outwardly of the inner or outer periphery of the discs from passing above or below that portion of any crystal held by the holder which also protrudes beyond such peripheries. Such means comprise the rings 60, 62 which are attached to the lower and upper discs, respectively, and which tightly but preferably movably surround their respective discs, and the rings 68, 70 which are attached to the lower and upper discs, respectively, within the central openings therein. According to the invention, the rings 60 and 68 are so attached to the lower disc that their upper surfaces 64 are spaced below the abrasive surface of the lower disc by a distance which is less than the thickness of the work holder 50 which is being used at any time. The rings 62 and 70 are so attached to the upper disc that their lower faces 66 are spaced above the abrasive surface of the upper disc by a distance which is less than the thickness of the work holder 50. By reason of their movable connection to the respective discs the positions of the rings may be adjusted as the discs wear.

It will be seen that if the part of a work holder which protrudes beyond the inner or outer peripheral edge of the discs is deformed, for example as shown in broken lines in Fig. 3, it cannot deform as much as its own thickness by reason of the ring 60 or 68 and, therefore, cannot deform or bend sufficiently to pass below the lower surface of the crystal. If, for any reason, the work holder should be deformed upwardly instead of downwardly the ring 62 or 70 would act in the same manner to prevent the protruding part of the work holder from passing above the upper surface of the crystal.

While I have described my invention with reference to the grinding of crystals, it will be understood that the invention is of general application and is not limited to the grinding of any particular materials or devices. It will also be understood that while I have described my invention with reference to a machine having fixed, horizontal, vertically-spaced abrasives, it may, without departing in any way from the invention, be applied to other types and constructions of grinding machines.

Although only one form of the invention is illustrated and described in this application, it will be understood by those skilled in the art that modifications and improvements may be made without departing in any way from the spirit or scope of the invention, for the limits of which reference must be had to the appended claims.

I claim:

1. A lapping machine comprising upper and lower abrasive discs, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a work piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will be moved radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its outermost position of radial movement a part of each work piece passes beyond the outer periphery of the discs, and means for preventing the work holder from passing under or over the work piece held thereby as parts of the work holder and work piece extend beyond the periphery of the discs, said means comprising a ring attached to and surrounding at least one of said discs, the annular face of each ring adjacent and parallel to the working face of the disc to which it is attached being spaced from such working face by a distance less than the thickness of the work holder which is being used.

2. A lapping machine comprising upper and lower abrasive discs having registering central openings therein, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a work piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will move radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its innermost position of radial movement a part of each work piece passes beyond the inner periphery of the discs, and a ring attached to the inner periphery of at least one of said discs within the central opening therein, the annular face of which adjacent and parallel to the working face of the abrasive disc to which it is attached being spaced from such working face by a distance less than the thickness of the work holder.

3. A lapping machine comprising upper and lower abrasive discs having registering central openings therein, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a work piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will move radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its innermost and outermost positions of radial movement a part of each article passes beyond the inner and outer peripheries of the discs, and means for holding the part of the work holder which extends beyond either periphery of the discs within a space between the upper and lower faces of a work piece held thereby, said means comprising a ring attached to and surrounding each of said discs and a ring attached to each disc within the central opening therein, the upper surface of each ring attached to the lower disc being spaced below the upper surface of the lower disc by a distance less than the thickness of the work holder

and the lower surface of each ring attached to the upper disc being spaced above the lower surface of the upper disc by a distance less than the thickness of the work holder.

4. A lapping machine comprising upper and lower abrasive discs, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a work piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will be moved radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its outermost position of radial movement a part of each work piece passes beyond the outer periphery of the discs, and a ring surrounding and mounted on at least one of the discs for adjusting movement toward and away from the working face thereof.

5. A lapping machine comprising upper and lower abrasive discs having registering central openings therein, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a work piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will move radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its innermost position of radial movement a part of each work piece passes beyond the inner periphery of the discs, and a ring mounted on the inner periphery of at least one of said discs within the central opening therein for adjusting movement toward and away from the working face thereof.

6. A lapping machine comprising upper and lower abrasive discs having registering central openings therein, a plurality of work holders disposed between the discs and arranged in a series about the common center thereof and each having at least one opening therethrough within which a piece is adapted to be held, means for causing planetary movement of said work holders about the common center of the discs and rotary movement about their individual axes whereby work pieces held by the work holders will move radially and circumferentially over the discs, the dimensions of the discs and of the work holders being such that in its innermost and outermost position of radial movement a part of each work piece passes beyond the inner and outer peripheries of the discs, and means for holding the part of the work holder which extends beyond either periphery of the discs within a space between the upper and lower faces of a work piece held thereby, said means comprising a ring attached to and surrounding each of said discs and a ring attached to each disc within the central opening therein.

GROVER C. HUNT.