

[54] **MACHINE FOR PARALLELLY
LAPPING OPPOSITE SURFACES OF A
WORKPIECE**

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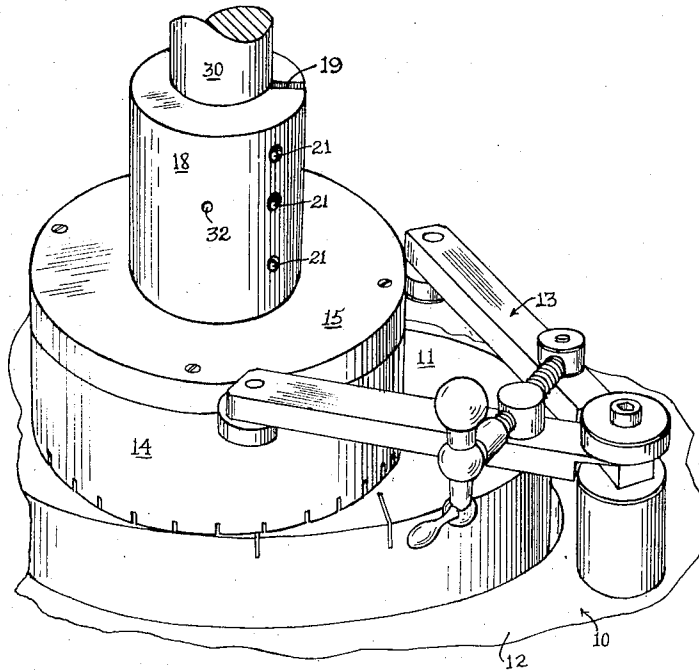
[52] U.S. Cl. **51/131**
[51] Int. Cl. **B24b 37/00**
[58] Field of Search **51/129, 131**

[56] **References Cited**
UNITED STATES PATENTS
3,233,370 2/1966 Best 51/131
2,971,298 2/1961 Garthwaite 51/131

Primary Examiner—Harold D. Whitehead
Attorney—Edward C. Threedy

[57] **ABSTRACT**
An improvement in a machine for parallelly lapping opposite surfaces of a workpiece by a rotatable lapping plate on which the work is positioned within a base or workholding ring beneath a pressure plate keyed to the ring for rotation therewith about a fixed vertical axis common to both the ring and the pressure plate and with the pressure plate self-adjustable vertically relative to such axis by engagement of the pressure plate with the work being lapped.

2 Claims, 6 Drawing Figures



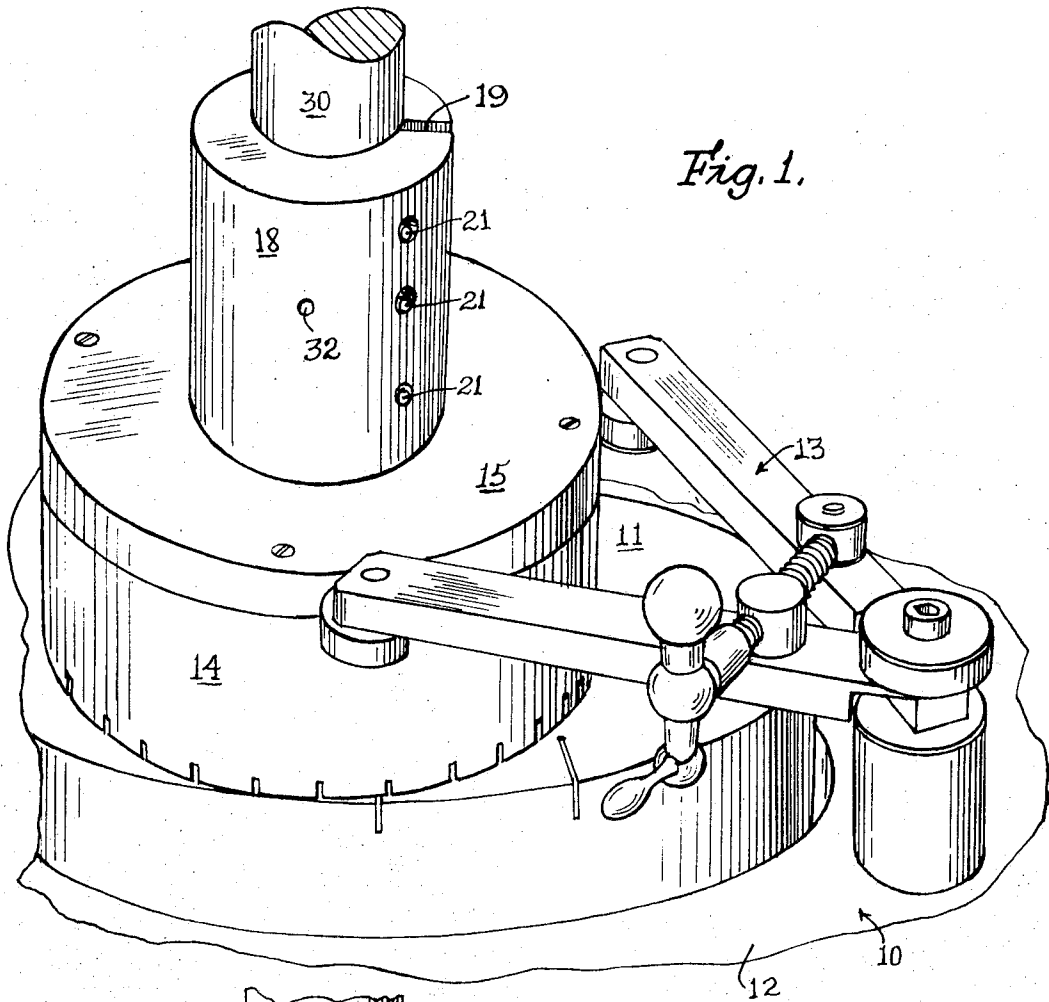


Fig. 1.

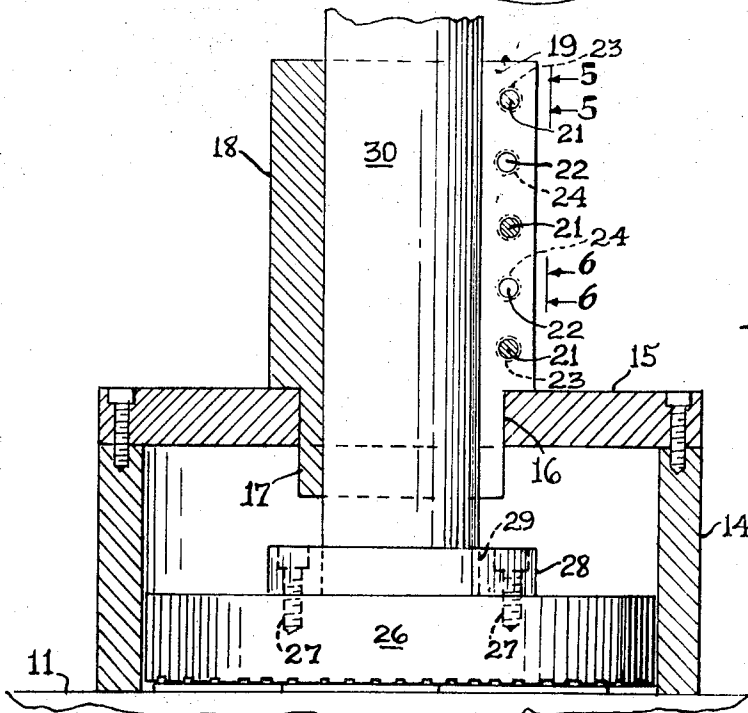


Fig. 2.

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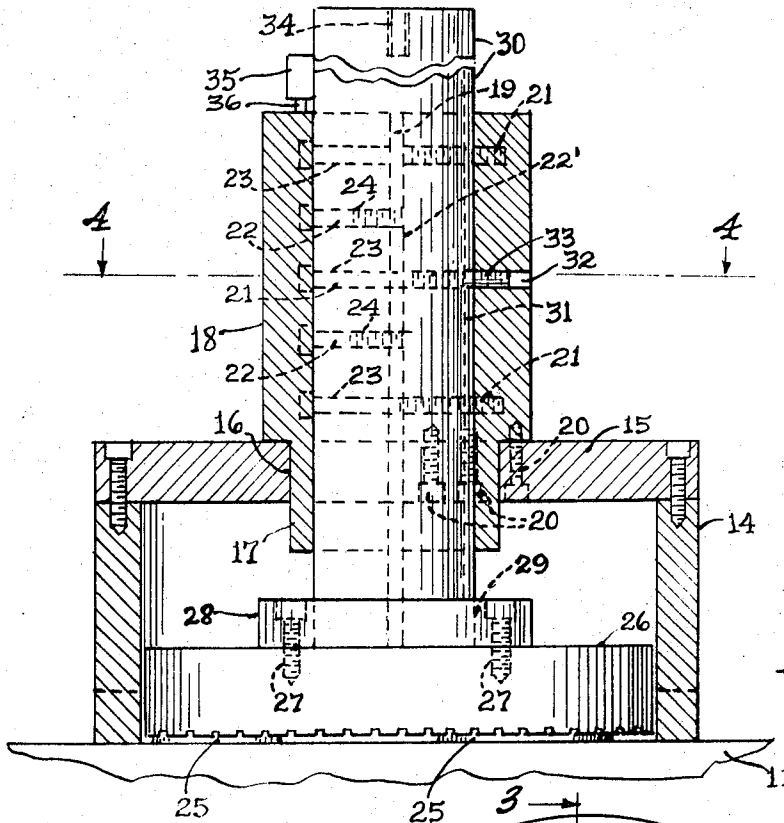


Fig. 3.

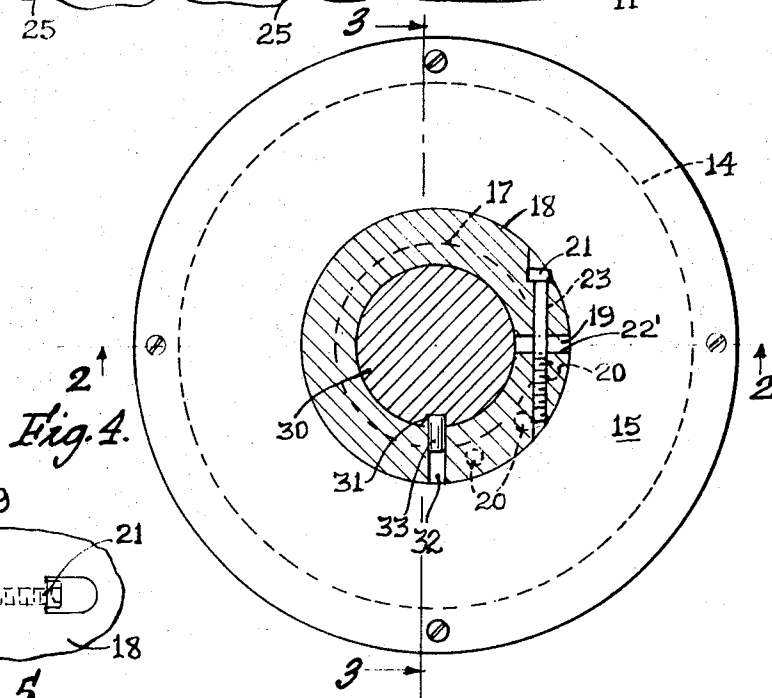


Fig. 4.

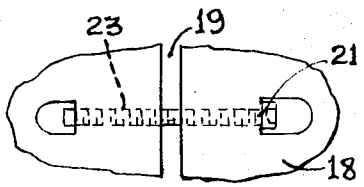


Fig. 5.

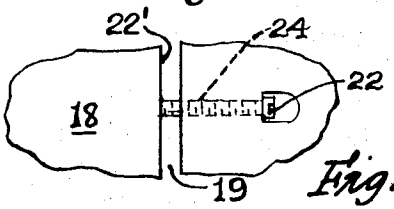


Fig. 6.

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MACHINE FOR PARALLELLY LAPPING OPPOSITE SURFACES OF A WORKPIECE

SUMMARY OF THE INVENTION

The conventional lapping machine employed for parallelly lapping opposite sides of a relatively flat workpiece in general comprises a rotatable lapping plate supporting a work or wear ring within which the work to be lapped is positioned upon the lapping surface of the lapping plate. A pressure plate is disposed within the confines of the ring upon the work, for bearing the work upon the lapping surface of the lapping plate. The work ring is rotated about a vertical axis by virtue of its engagement with the lapping plate independently of the rotation of the pressure plate. The ring is maintained upon the lapping plate by a fixture engaging the ring in such manner as to permit the ring to rotate under action of the lapping plate while being retained in position upon such plate.

In practice, where it is desirable and often required that the opposite sides of a relatively flat workpiece be lapped with ultra precision, for example, in the area of 0.00000010 inch, such machines have been found to be impractical for such purpose and yet useful for ordinary lapping.

My invention accomplishes ultra precision lapping by arranging the work ring and the pressure plate with respect to each other whereby they are simultaneously rotated together about a fixed vertical axis common to both the ring and the pressure plate and with the pressure plate self-adjustable vertically relative to such axis by engagement of the pressure plate with the surface of the work being lapped.

I have found that to accomplish this ultra precision lapping, the pressure plate must be keyed to the ring for rotation therewith about the vertical fixed axis, while permitting the pressure plate to have self-adjustment vertically relative to such axis by engagement of the pressure plate with the surface of the work being lapped. This arrangement results in high spots or surfaces on the work being lapped away, so that the final result is an ultra precision lapped surface in the aforesaid area of 0.00000010 inch.

This important object of my invention is accomplished by the preferred form of construction shown in the accompanying drawings, and in which:

FIG. 1 is a fragmentary perspective view of a lapping machine embodying my improvements;

FIG. 2 is a sectional detail view taken substantially on line 2-2 of FIG. 4;

FIG. 3 is a sectional detail view taken substantially on line 3-3 of FIG. 4;

FIG. 4 is a sectional detail view taken substantially on line 4-4 of FIG. 3;

FIG. 5 is a fragmentary detail elevational view taken substantially on line 5-5 of FIG. 2;

FIG. 6 is a fragmentary detail elevational view taken substantially on line 6-6 of FIG. 2.

GENERAL DESCRIPTION

In the drawings, 10 indicates a lapping machine (shown fragmentarily) which includes a rotatable lapping plate 11 of a construction and formed of a material well known in the art.

On the base 12 of the lapping machine is mounted a retaining structure 13 for the work or wear ring 14. This structure 13 is substantially identical to that shown in U.S. Pat. No. 3,521,409, dated July 21, 1970 and operates in substantially the same manner. The function and description of such retaining structure will therefore not be repeated herein.

My improvement comprises forming in the top plate 15 of the wear ring 14 a central opening 16. Projected into this opening 16 is a reduced end portion 17 of a sleeve 18. The sleeve 18 is slit longitudinally as at 19. Adjacent the slit 19 of the sleeve 18 and located in an area approximately a quarter of the diameter of the sleeve are bolts 20 by which the sleeve 18 is connected to the top plate 15 of the ring 14.

Located on the slit side of the sleeve 18 are two sets of bolts 21 and 22. The bolts 21 are threaded into threaded openings

23 and are utilized for a purpose hereinafter explained. The bolts 22 are threaded into threaded openings 24 for reasons hereinafter explained. These bolts 22 are of a length sufficient to bear the ends of the bolts against the sleeve surface opposite the slit 19 for reasons hereinafter explained.

Arranged within the ring 14 for positioning upon the workpieces 25 placed upon the lapping plate 11, is a pressure plate 26. Secured by bolts 27 to the top of the pressure plate 26 is a collar 28 into which projects the lower end portion 29 of a ram 30. This portion 29 of the ram is welded or otherwise secured to the collar 28.

The ram 30 projects through the sleeve 18 and is provided with a longitudinally extending keyway 31. Mounted on an opening 32 formed in the sleeve 18 is a key 33 which projects into the keyway 31. The outside diameter of the ram 30 is such as permits a snug fit between the ram 30 and the sleeve 18.

One of the important requirements of my improvement in order to accomplish the ultra precision lapping is that the pressure plate 26 and ring 14 must not only rotate together, but must also rotate about a fixed vertical axis, permitting no lateral tilting of the pressure plate 26 with respect to such axis. This I accomplish by the provision of the elongated sleeve 18 which has sufficient length to provide rigidity between the sleeve and the ram 30 while permitting self-adjustment of the pressure plate 26 with respect to the fixed vertical axis by engagement of the pressure plate with the work being lapped. Such self-adjustment is varied by adjustment of the bolts 21. Threading these bolts 21 clockwise as viewed in FIG. 4, will press the sleeve 18 upon the ram 30. By threading these bolts 21 in an anticlockwise direction and by threading the bolts 22 in a clockwise direction, such bolts will bear upon the adjacent surface 22' of the sleeve which is defined by the slit 19 and force the sleeve 18 to expand, thus decreasing the frictional engagement between the ram 30 and the sleeve 18 to permit longitudinal movement of the ram with respect to the sleeve.

There is provided in the top portion of the ram 30 a threaded opening 34 by means of which a lifting tool or device may be attached for the purpose of lifting the pressure plate 26 and the ring 14 off the lapping plate 11. There may also be attached to the upper portion of the ram 30 a gauge or limiting switch diametrically illustrated at 35 which includes a plunger 36 adapted to measure the degree of lapping of the work. The details of this gauge or limiting switch 35 have not been disclosed, as any gauge or limiting switch may be utilized for the purpose.

From the foregoing description, it will be apparent that I have provided an arrangement wherein the pressure plate is keyed to the work or base ring 14 for simultaneous rotation therewith about a fixed vertical axis, while permitting the pressure plate 26 to have self-adjustment vertically relative to that fixed axis by engagement of the pressure plate with the work being lapped.

In this connection, should there be any high or uneven spots or areas on the surface of the work being lapped, these uneven or high surfaces will be lapped away, leaving the entire surface of the work with an ultra precision lapped finish. This could not be accomplished if the pressure plate 26 was capable of any movement relative to the ring 14.

As in the conventional lapping machine, it is preferable that the rotation of the base or work ring 14 be as a result of its engagement with the lapping plate 11. This rotation of the ring 14 by the lapping plate 11 is transmitted to the pressure plate 26 by the keyed connection therewith. The ring 14 is formed of conventional material used in the lapping machines for maintaining the surface of the lapping plate 11 in condition.

In operation the work to be lapped is placed upon the lapping plate 11 beneath the pressure plate 26 and within the confines of the base or work ring 14. In this position the surface of the work in engagement with the lapping plate 11 will be subjected to a lapping operation which, as before stated, results, by reason of the relationship of the pressure plate and the ring, in an ultra precision lap. After this has been accomplished, the pressure plate and ring are removed from position

upon the lapping plate so that the work may be removed and turned over so as to subject the opposite side of the work to the same degree of lapping operation and finish, with the result that both surfaces of the work are parallelly lapped with ultra precision. During the lapping operation an abrasive compound is fed in any suitable manner to the surface of the lapping plate.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. An improvement in a machine for ultra precision parallel lapping of the opposite surfaces of a workpiece by a rotatable lapping plate, comprising:

- a. a base ring having a top wall and positioned on and rotatable by the lapping plate,
- b. an elongated longitudinally slit sleeve connected to and extending from said top wall,
- c. an elongated ram embraced by said sleeve and having

- longitudinal movement with respect thereto,
 - d. a pressure plate arranged within said ring and connected to said ram,
 - e. said ram having an elongated longitudinally extending keyway formed in one side thereof,
 - f. a key carried by said sleeve and engaging said keyway to provide rotatable connection between said sleeve and said ram while permitting longitudinal movement of the ram relative to the sleeve,
 - g. means for contracting and expanding said sleeve to vary the degree of frictional engagement between the sleeve and the ram,
 - h. said means comprising two sets of bolts, the ends of one of said bolts engaging the wall surfaces of the sleeve defined by the slit and adapted to expand said sleeve when rotated in a clockwise direction, the other set of bolts threaded into openings formed in the sleeve for contracting the sleeve when said bolts are rotated in a clockwise direction.
2. The improvement defined in claim 1 wherein the means for connecting the sleeve to the top wall comprises bolts connecting the sleeve to the top wall adjacent and to one side of the longitudinal slit in the sleeve.

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