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L. DAY ET AL
LAPPING MACHINE

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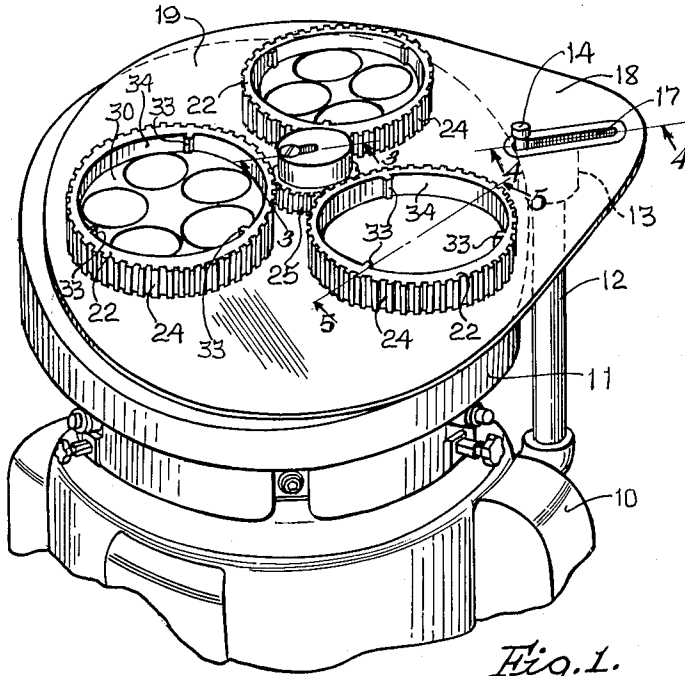


Fig. 1.

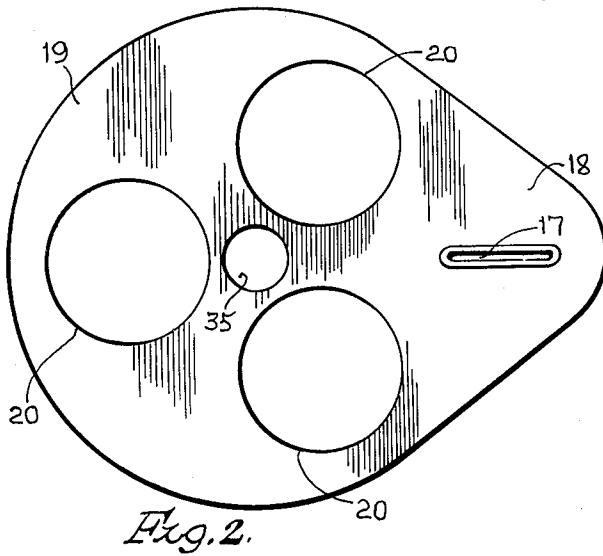


Fig. 2.

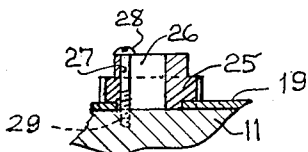


Fig. 3.

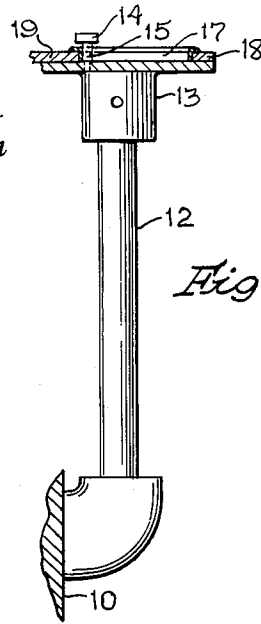


Fig. 4.

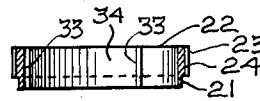


Fig. 5.

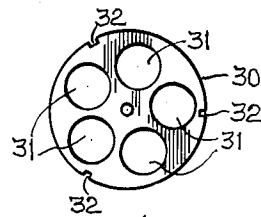


Fig. 6.

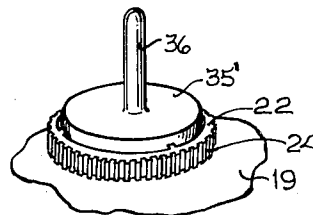


Fig. 7.

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LAPPING MACHINE

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12 Claims. (Cl. 51—133)

Our invention relates to certain new and useful improvements in a lapping machine. It has for its principal object the provision of a lapping machine developed to provide a low cost tool for producing the finest micro-inch finish with maximum speed and a minimum degree of labor; a machine which can be easily operated by the non-experienced and which requires very little attention during the lapping operation.

Summarily, an object of the invention is to provide a lapping machine having provision for moving the work over the surface of a rotating lapping table while the work is being rotated independently of the movement of the lapping table.

More specifically, an object of the invention is the provision of a lapping machine in which the work will have an oscillatory eccentric movement within a confined path over the lapping table while the work rotates in a direction opposite to the direction of the rotation of the lapping table, thus resulting in producing, as before stated, a micro-inch finish within a minimum space of time and with the minimum degree of labor and equipment.

Another object of the invention is to provide in a lapping machine an arrangement for varying the degree of movement of a work-moving plate over the lapping table.

Other objects will appear hereinafter.

The invention consists in the novel combination and arrangements of parts to be hereinafter described and claimed.

The invention will be best understood by reference to the accompanying drawings showing the preferred form of construction, and in which:

Fig. 1 is a fragmentary perspective view of the lapping machine embodied in the invention;

Fig. 2 is a plan view of a work moving plate embodied in the invention;

Fig. 3 is a fragmentary sectional detail view taken on line 3—3 of Fig. 1;

Fig. 4 is a fragmentary sectional detail view taken substantially on line 4—4 of Fig. 1;

Fig. 5 is a sectional detail view taken substantially on line 5—5 of Fig. 1;

Fig. 6 is a plan view of a work holding plate embodied in the invention;

Fig. 7 is a perspective view of one of the work moving rings embodied in the invention, showing a weight within its confines disposed upon the work therein.

Referring more particularly to the drawings in which the preferred form of construction of my invention is shown, 10 indicates a supporting base which may be of any conventional size or design on which there is rotatably supported a lapping table 11. This lapping table 11 may be supported in a conventional manner for rotation relative to the base 10 and be rotated in one direction by a suitable motor (not shown) or the like.

This lapping table is of a conventional design, in the lapping surface of which may be cut a helical groove to make more effective the lapping operation. It is, however, to be understood that the surface of the lapping

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table on which the work is to be disposed may be of any conventional design now in use.

At one side of the base 10 and secured thereto in any suitable manner is located a post 12. This post 12 has a flanged cap 13 to which is secured adjacent the peripheral edge thereof a guide screw or bolt 14, the shank 15 of which works in an elongated slot 17 formed in the projecting portion 18 of a relatively flat plate 19, the major portion of which plate is circular to conform to the form of the top surface of the lapping plate 11. This plate 19 may be formed of any suitable material and of any desired thickness best suited for the purpose and may be provided with a plurality of openings 20 within each of which openings is arranged the reduced base portion 21 of a confining ring 22, the upper portion 23 of which extends a predetermined distance above the top surface of the plate 19. Each of the rings 22 provides on its peripheral edge gear teeth 24 which mesh with a pinion 25. This pinion 25 has a radially and vertically extending elongated slot 26. Projecting through this slot 26 is the shank 27 of a bolt 28 threaded as at 29 into the lapping table 11. The head of this bolt may be provided with a slot to facilitate turning by means of a screw driver or Allen wrench. This bolt 28 may be square or hexagonal to facilitate turning thereof by means of a wrench or other tool. The bolt 28 is positioned slightly offset, preferably, though not necessarily, approximately one-inch from the vertical axis of the lapping table 11. The bolt 28 fixedly secures the pinion 25 to the lapping table for rotation therewith.

In one or more of the rings 22 may be arranged a work holding plate 30, in which plate there may be provided a plurality of work receiving openings 31. To facilitate rotation of the plate 30 with the rings 22, I provide in the plate notches 32 which receive vertical ribs 33 formed on and extending laterally from the inside wall 34 of the ring. These ribs and notches may be omitted, if desired, without depreciating the lapping results of the machine. However, when the notches and ribs 32 and 33 are provided, it is clear that the plates 30 will rotate with the rings 22. The plate 19 has an opening 35 to accommodate the pinion 25.

The parts are assembled in the manner shown in Fig. 1. When thus assembled and when work is confined within the rings 22 without the employment of the plates 30, the rotation of the lapping table will, through the pinion 25, impart rotation to the rings 22 in a direction opposite to the rotation of the lapping plate 19. This will result in movement of the work in a direction opposite to the movement of the work over the lapping table 11, resulting from the oscillatory eccentric movement of the plate 19. When the work is confined in the openings 31 of the work holding plates 30, the work during the oscillatory eccentric movement over the lapping table 11 by action of the plate 19, will have an additional rotatable movement within the rings 22, all of which greatly increases the effectiveness of the work lapping table. The pivotal movement of the plate 19 in its circular movement over the work table 11 is about the shank 15. The degree of this pivotal movement may be afforded by the operator varying the position of the plate 19 with respect to the work lapping table 11. This is accomplished by loosening the bolt 28 and moving the gear 25 to dispose the bolt nearer or farther away from the axis of rotation of the plate 11. If the axis of the gear 25 is in alignment with the axis of the plate 11, it will be understood that the plate 19 will not move relative to the plate 11 but will remain stationary.

The openings 20 and 31 may be of various sizes and shapes to accommodate the work; depending upon the lapping finish desired, the lapping operation may be effected with or without the plates 30, and the plates 30

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may be constructed without the notches 32 so as not to rotate with the gears 22. In such instance the diameter of the plates 32 may be of a length sufficient to provide clearance for the ribs 33 when the plates 30 are mounted within the rings 22.

From the foregoing description it will be seen that I provide a lapping machine which results in a multiple movement of the work during the lapping operation, with the result that precision lapping is accomplished with the minimum amount of time and labor and equipment.

Any approved standard lapping compound may be used in the operation accomplished by our machine.

If desired, a suitable weight 35 may be provided. In such case, the weight is of a diameter to fit within the ring 22 upon the work contained therein. To facilitate removal of the weight a suitable handle 36 may be provided.

As the several parts of our lapping machine may be removed, the cleaning of such parts, particularly the removal of the lapping compound therefrom, may be accomplished expeditiously and economically.

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

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

1. A lapping machine comprising a supporting base, a lapping table carried by said base for rotation in a horizontal plane with respect thereto, a relatively flat work-holding plate mounted upon said table, means connecting said plate to the base to permit limited horizontal movement of the plate relative to the table, and means rotatable with the table and engaging the plate for moving said plate in an oscillatory eccentric path relative to the table.

2. The device of claim 1 characterized by the inclusion of work-holding openings formed in said plate.

3. The device of claim 2 characterized by the inclusion of work holders mounted in said work-holding openings for rotation relative to said plate and movable with the plate horizontally over the table, and means operatively connecting said work holders to said plate moving means to rotate said work holders within said work-holding openings in a direction opposite to the movement of the plate.

4. The device of claim 2 characterized by the inclusion of means for adjustably connecting said plate

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moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

5. The device of claim 3 characterized by the inclusion of means for adjustably connecting said plate moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

6. The device of claim 1 characterized by the inclusion of means for adjustably connecting said plate moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

7. A lapping machine comprising a supporting base, a lapping table carried by the base for rotation in a substantially horizontal plane with respect thereto, a relatively flat work-holding plate mounted upon said table, means carried by the base and having slot and pin connection with the plate for permitting limited horizontal movement of the plate relative to the table, and means rotatable with the table and engaging the plate for moving said plate in an oscillatory eccentric path relative to the table.

8. The device of claim 7 characterized by the inclusion of work-holding openings formed in said plate.

9. The device of claim 8 characterized by the inclusion of work holders mounted in said work-holding openings for rotation relative to said plate and movable with the plate horizontally over the table, and means operatively connecting said work holders to said plate moving means to rotate said work holders within said work-holding openings in a direction opposite to the movement of the plate.

10. The device of claim 8 characterized by the inclusion of means for adjustably connecting said plate moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

11. The device of claim 9 characterized by the inclusion of means for adjustably connecting said plate moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

12. The device of claim 7 characterized by the inclusion of means for adjustably connecting said plate moving means to said table to vary the oscillatory eccentric movement of the plate relative to the table.

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