

Nov. 30, 1926.

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S. PLAYER

LAPPING MACHINE

Filed July 10, 1923

2 Sheets-Sheet 1

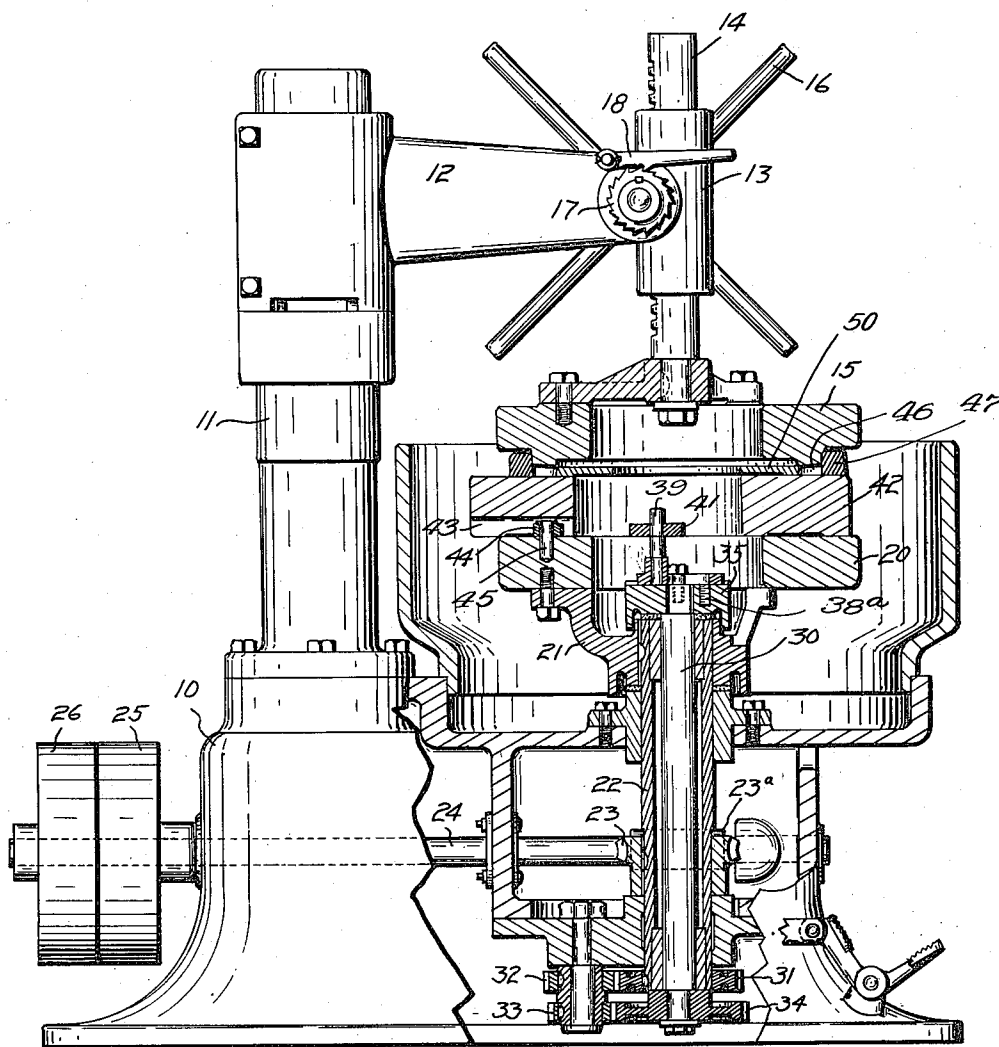


Fig. 1

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2 Sheets-Sheet 2

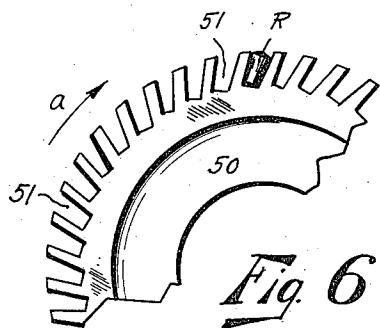
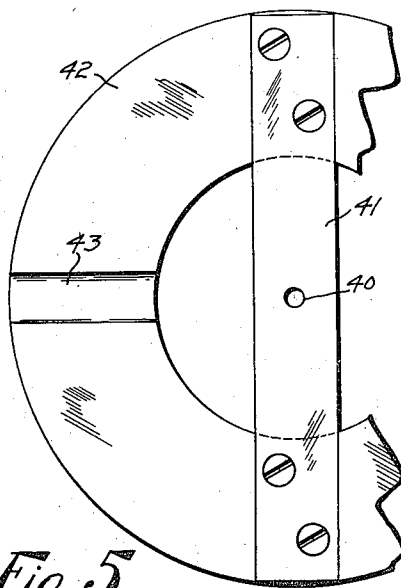
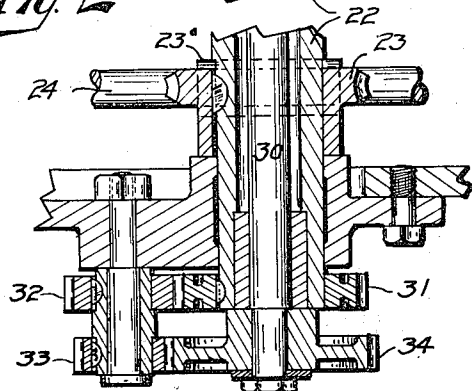
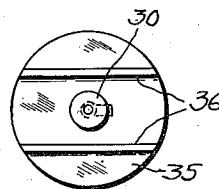
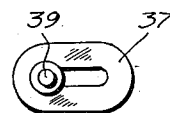
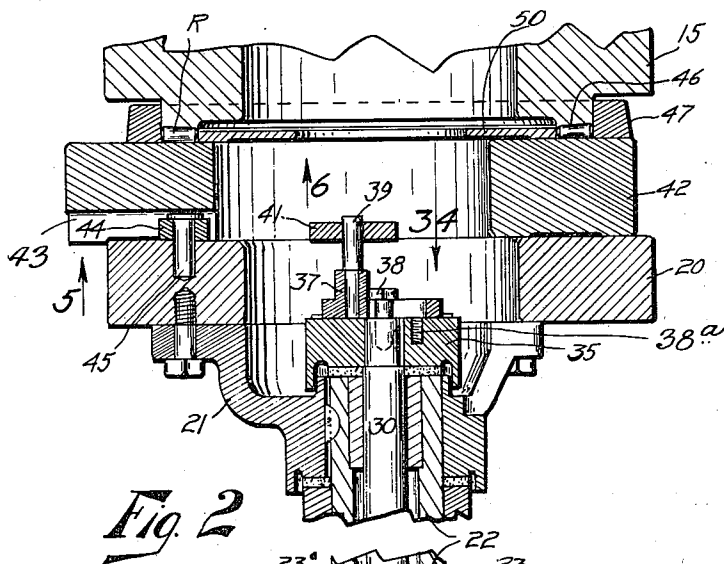


Fig. 5

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UNITED STATES PATENT OFFICE.

SYDNEY PLAYER, OF WESTBORO, MASSACHUSETTS, ASSIGNOR TO BETHEL-PLAYER CO., OF WESTBORO, MASSACHUSETTS, A COPARTNERSHIP CONSISTING OF JOSEPH N. BETHEL AND SIDNEY PLAYER.

LAPPING MACHINE.

Application filed July 10, 1923. Serial No. 650,678.

This invention relates to a lapping machine capable of general application but particularly designed for producing an accurately finished surface on cylindrical or conical work. Such machines operate upon the work by revolving or rolling the work between relatively movable lapping surfaces.

An important feature of my invention consists in providing a lapping machine in which one lapping surface is relatively fixed and non-rotatable and the other lapping surface receives a combined circular and eccentric motion, the mechanism for producing such motion also forming a part of my invention.

A further feature of my invention relates to the provision of a work spacing or positioning device by means of which the work is held in a selected angular relation during the lapping operation.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings, in which—

Fig. 1 is a side elevation partly in section of my improved lapping machine.

Fig. 2 is an enlarged sectional side elevation of the upper and lower laps and parts of the driving mechanism therefor;

Figs. 3 and 4 are detail plan views of separate parts, looking in the direction of the arrows 3 and 4 in Fig. 2;

Fig. 5 is a bottom view of the movable lower lap, looking in the direction of the arrow 5 in Fig. 2, and

Fig. 6 is a similar view of the work spacing and positioning device, looking in the direction of the arrow 6 in Fig. 2.

Referring to the drawings, I have shown a lapping machine which is in general of the construction disclosed in the prior British patent of J. N. Bethel, No. 216,684 of May 16, 1923. This lapping machine comprises a base or frame 10 having a post 11 slidably supporting an arm 12 having a bearing 13 for a rack bar 14, to the lower end of which is secured the non-rotatable lap 15. The bar 14 and lap 15 are held from rotation but are adjustable vertically by a pinion (not shown) manually operated by handles 16 and held in raised position

by a ratchet 17 and locking pawl 18. The lap 15 is preferably a slightly loose fit on the reduced lower end of the bar 14 so that the lap is capable of slight movement to adjust itself to the plane of the surface of the movable lap. A drive plate 20 is connected through a support 21 and sleeve 22 to a worm gear 23 rotated by a worm 23^a on a drive shaft 24 mounted in the base of the frame 10 and provided with tight and loose pulleys 25 and 26. Through these connections the drive plate 20 is continuously rotated about the axis of the sleeve 22 and worm gear 23.

A shaft 30 is rotatably mounted in bearings in the sleeve 22, from which it receives motion through differential gears 31, 32, 33 and 34. The gears 32 and 33 are mounted on the same bushing so that they rotate together, and the gears 31 and 34 are secured to the sleeve 22 and shaft 30 respectively. A slight difference in the ratios of the two pairs of gears causes the shaft 30 to rotate at a slightly different speed from the sleeve 22, the amount of speed variation depending upon the gear ratios selected.

The shaft 30 is provided with a disc 35 having a guide-way 36 (Fig. 4) in which a plate 37 is slidably mounted, the plate being secured in adjusted position by a clamping screw 38 (Fig. 2). The parts thus far described are substantially as shown in the Bethel patent above noted and in themselves form no distinctive part of my invention.

The slide 37 carries a stud 39 which projects upwardly through an opening 40 in a cross bar 41 fixed in the lower portion of a movable lap 42.

The lap 42 also has a radial groove 43 in its lower face which receives a roll 44 (Fig. 2) on a stud 45 fixed in the drive plate 20. When conical work is to be ground, such as the conical rolls of a common type of roller bearings, the lower face of the fixed lap 15 is formed with a projecting annular surface 46 inclined at such an angle that it will contact with the upper surface of a conical roller lying on the flat surface of the lap 42. A ring 47 loosely surrounds the projection 46 and prevents radial displacement of the work.

A spacing or positioning device 50 rests

upon the upper surface of the lap 42 and is provided with slots or recesses 51 to receive and position the conical rolls R (Fig. 6). It has been found advantageous to position the rolls at an oblique angle to the radius passing therethrough and in the construction shown in the drawings, the angle of 21° has been selected. This angle will, of course, vary with the size and taper of the work and also with the diameter of the laps. The direction of rotation is indicated by the arrow *a* in Fig. 6.

Having thus described the construction of my improved lapping machine, the method of operation will be readily understood. The ring 47 and spacing plate 50 may be placed on the upper surface of the movable lap 42 and the slots in the spacing plate may then be filled with rolls R while the fixed lap 15 is in raised position. The lap 15 is then lowered and the ring 47 is guided to receive the projection 46. When the lap 15 is in contact with the rolls R the machine is set in operation and the lap 42 moves under the rolls R with a combined circular and eccentric motion, as the lap is continuously rotated by the roller 44 in the groove 43 and also receives an eccentric motion from the stud 39 projecting through the central opening 40 in the cross bar 41. This combined circular and eccentric motion causes the rolls R to progressively engage a very large proportion of the lapping surface of the lap 42 and produces very desirable results in the work. A substantially perfect cylindrical or conical form is imparted to the work and the production of surface irregularities or "flats" is reduced to a minimum.

An important advantage of my improved lapping machine lies in the fact that the outer beveled end portion of each conical roll is also lapped against the inner face of the ring 47 simultaneously with the lapping of the body portion of the roll and concentric therewith.

Certain of the advantages of my invention may also be utilized in the production of flat or non-circular work. I may also set the drive pin 39 concentric with the shaft 30 by placing the clamping screw 38 in a threaded hole 38^a located eccentric to the shaft 30 in the disc 35, and swing the upper fixed lap 15 to a position out of axial alignment with the shaft 30. This arrangement I consider less desirable than that shown and illustrated herein. Having described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed otherwise than as set forth in the claims but what I claim is:—

1. In a lapping machine, a non-rotatable lap, a movable lap, and means to give said movable lap a combined circular and eccentric movement.

2. In a lapping machine, a non-rotatable lap, a movable lap, means to continuously revolve said movable lap, and additional means to give said lap an eccentric motion.

3. In a lapping machine, a non-rotatable lap, a movable lap, means to continuously revolve said movable lap, and additional means to give said lap an eccentric motion, the angular velocity of the eccentric motion being different from the angular velocity of the circular movement but in the same direction.

4. In a lapping machine, a non-rotatable lap, a movable lap having a substantially radial groove in its lower face, a driving plate having a continuous circular movement and having a driving roll, said roll being received in said groove, whereby said movable lap is given continued circular movement, and additional means to move said lap in an eccentric path.

5. In a lapping machine, a non-rotatable lap, a movable lap, means to continuously revolve said movable lap, and additional means to give said lap an eccentric motion, said latter means comprising a drive pin, means to move said drive pin about an axis eccentric thereto, and means to connect said drive pin to said movable lap adjacent the center of said lap.

6. In a lapping machine, a non-rotatable lap, a movable lap, means to continuously revolve said movable lap, additional means to give said lap an eccentric motion, and driving connections between said first driving means and said additional driving means effective to give the additional driving means a differential motion relative to the first driving means.

7. In a lapping machine, a non-rotatable lap having a circular work engaging projection, a ring loosely fitting said projection and forming an outward enclosure for the work, a movable lap and a spacing and positioning plate supported by said movable lap within said ring and having slots therein to receive the work and to hold each piece in spaced relation between said laps.

8. In a lapping machine, a non-rotatable lap, a movable lap, means to give said movable lap a combined circular and eccentric movement, a spacing and positioning plate supported by said lower lap but held from eccentric movement therewith, said plate having slots therein to receive the work and to hold each piece in spaced relation between said laps.

9. In a lapping machine, a non-rotatable lap, a movable lap, means to give said movable lap a combined circular and eccentric movement, a spacing and positioning plate supported by said lower lap but held from eccentric movement therewith, said plate having slots therein to receive the work and to hold each piece of work in spaced relation

between said laps and at a definite angle oblique to a radius of the spacing plate passing through the piece of work.

10. In a lapping machine for conical work, 5 a non-rotatable lap, a rotatable lap and a work holder movable on said rotatable lap, said work holder having work receiving recesses each disposed at a definite angle oblique to the radius passing through the 10 recesses, one of said laps having a flat surface and the other lap having an annular portion of its surface formed as a portion of a cone, both of said laps having line contact with the surface of the conical work when the 15 work is held at the angle determined by the recesses in the work holder.

11. A lapping machine having a non-rotatable lap and a movable lap, and in which the movable lap is given a circular or revolving movement about an axis which is 20 offset from the axis of the lap, and at the same time is given an eccentric motion with respect to said offset axis.

12. A lapping machine as claimed in claim 25 11, wherein said movable lap is given said eccentric motion by rotating the axis or center of the lap about said offset axis and

wherein means is provided for simultaneously guiding an outer portion of the lap for movement along a line radial with respect 30 to said offset axis.

13. In a lapping machine, a non-rotatable lap having a depending circular projection, a rotatable lap, a work-spacing and positioning plate movable on said rotatable lap, and 35 means to hold said plate concentric with said depending projection.

14. In a lapping machine, a non-rotatable lap having a depending circular projection, a rotatable lap, a work-spacing and position- 40 ing plate movable on said rotatable lap, and means to hold said plate concentric with said depending projection, said means comprising a ring supported by said rotatable lap and loosely encircling said plate and depending 45 projection.

15. In a lapping machine, a non-rotatable lap, a movable lap, means to continuously revolve said movable lap, and additional means to give said lap an eccentric motion 50 at a differential speed.

In testimony whereof I have hereunto affixed my signature.

SYDNEY PLAYER.