April 16, 1946. H. MICHELSEN ET AL 2,398,660

LAPPING MACHINE

Filed Dec. 18, 1943 2 Sheets-Sheet 1

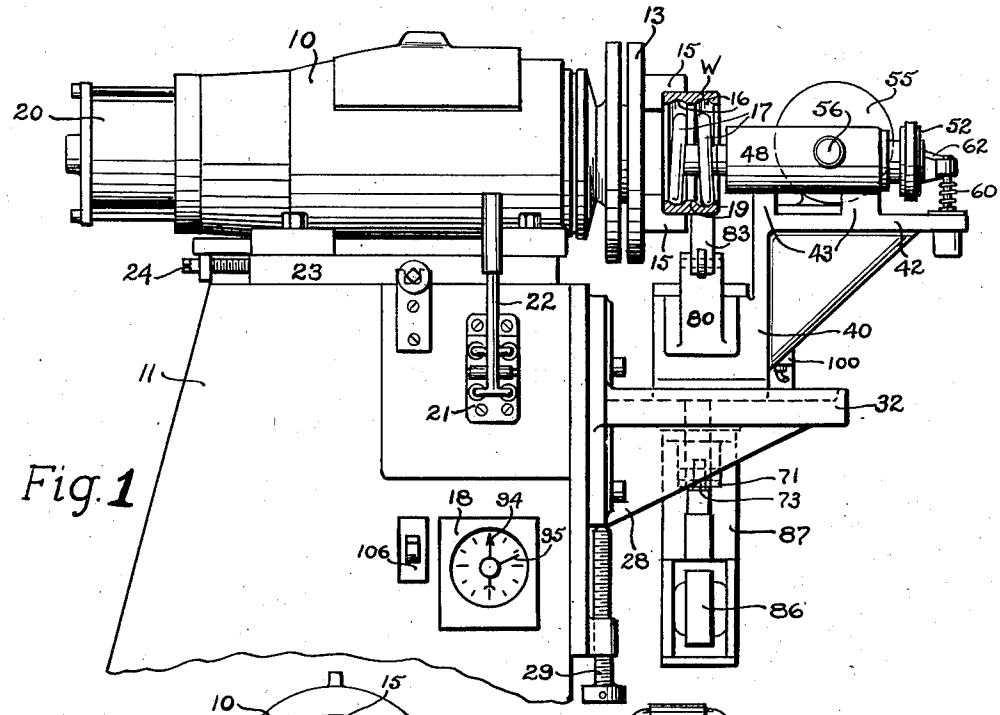


Fig. 1

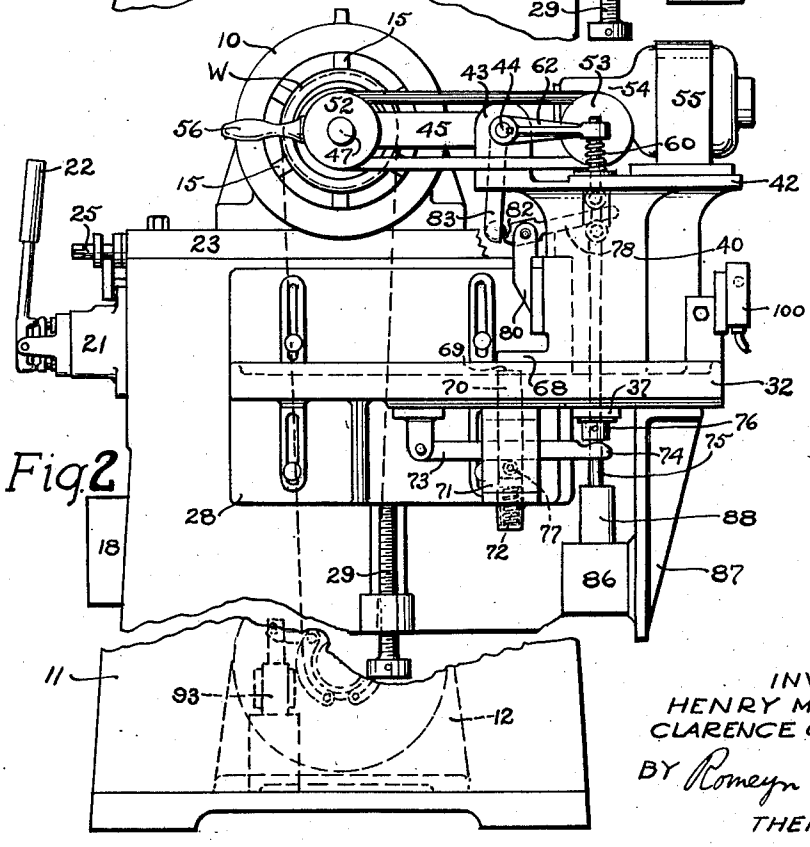


Fig. 2

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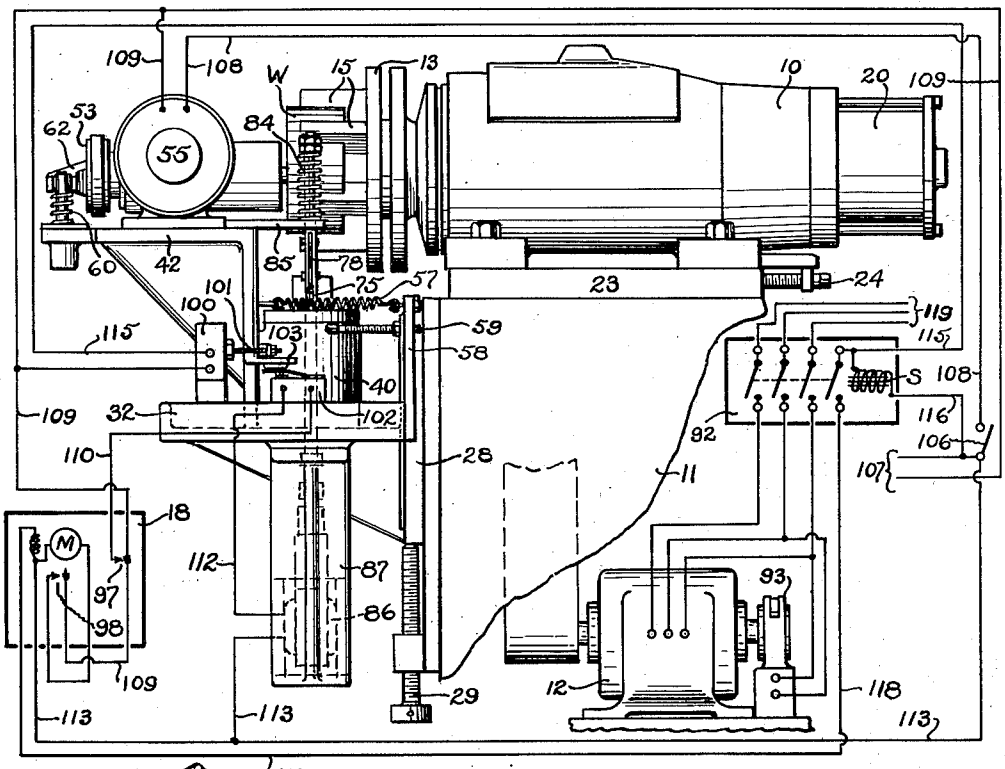


Fig. 3

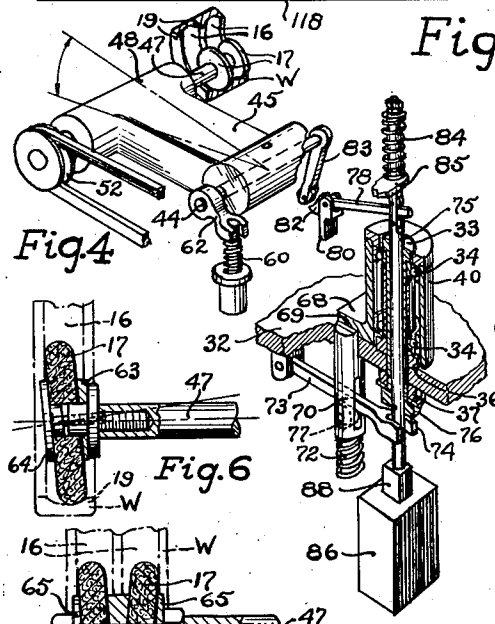


Fig. 4

Fig. 6

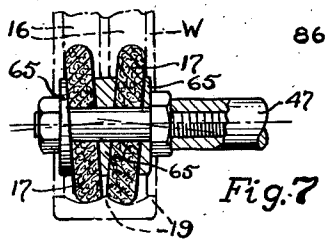


Fig. 7

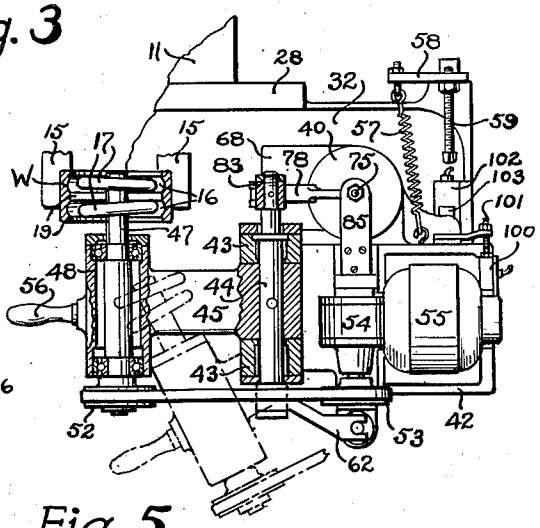


Fig. 5

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Patented Apr. 16, 1946 2,398,660

UNITED STATES PATENT OFFICE

2,398,660

LAPPING MACHINE

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Application December 18, 1943, Serial No. 514,736

23 Claims. (Cl. 51—105)

This invention relates to the finishing of annular surfaces and particularly to a machine for lapping surfaces of revolution which are curved in more than one plane, such as the raceways of ball bearings.

Very sensitive mechanisms such as delicate measuring instruments having rotatable parts, require antifriction bearings of extreme accuracy. The usual commercially ground raceways of antifriction bearings often have minute irregularities which cause variations in the rolling action and variation of rolling friction of the rolling elements engaging these raceways thus producing objectional vibrations and making the bearings unfit for use in such instruments. Heretofore, it has been common practice to try to remove some of these raceway irregularities by a hand-lapping operation. Hand-lapping of these raceways is slow and non-uniform since it depends principally upon the dexterity and judgment of a highly skilled operator who manually controls the pressure and movement of a lapping tool against a rotating raceway. This non-uniformity of lapping is particularly apt to occur in internal raceways since the lapping tool necessarily engages only a small surface area of the raceway. Hence, even with hand-lapped raceways many bearings are insufficiently accurate and insufficiently smooth running to meet the exacting requirements for precision instruments.

It is an object of this invention to provide an improved lapping machine which will rapidly and accurately produce duplicate controlled precision lapping operations on surfaces curved in more than one plane.

Another object is to provide an improved lapping machine wherein the rotation of a lapping wheel in engagement with a rotating work surface produces an ever-changing path of the lapping wheel along the work surface.

Another object is to provide a lapping machine wherein the rotation of a work piece being lapped is controlled by the movement of a lap towards and from a lapping position.

Another object is to provide an automatic lapping machine which removes a lap from a rotating work piece at the end of a predetermined lapping period and thereafter stops the rotation of the work piece.

To these ends and also to improve generally upon devices of the character indicated, the invention consists in the various matters hereinafter described and claimed. In its broader aspects, the invention is not necessarily limited to the specific constructions selected for illustrative purposes in the accompanying drawings wherein

Figure 1 is a fragmentary elevation of one side of the invention;

Figure 2 is a front elevation;

Figure 3 is a fragmentary side elevation including a schematic wiring diagram;

Figure 4 is a fragmentary perspective view of the mechanism for moving the laps into and out of lapping position;

Figure 5 is a fragmentary plan view; and

Figures 6 and 7 are fragmentary views illustrating the lapping wheel mountings.

A work head 10, carried by a base 11, has a rotatable shaft belt-driven from a motor 12 in the base, and a chuck 13, on one end of this shaft, has jaws 15 for demountably holding and rotating a work piece, as an antifriction bearing race ring W, about its geometrical axis. The race ring W may be provided with one or more grooved circular raceways 16 which are transversely and longitudinally curved for receiving rolling elements such as balls. The final precision finish on these raceways is produced by applying a lap as a lapping wheel 17 under a predetermined pressure and with a wabbling rotation to each of these raceways while rotating the work piece W at a predetermined rate of speed, the speeds of lapping wheel and work piece rotation being so chosen that each lapping wheel engages its raceway in a non-repeating ever-changing path. An electric timer 18 is adjusted to operate controls so that at the end of a predetermined lapping cycle, the laps 17 are lifted out of lapping position and swung past shoulders 19, forming sides of these raceways, to inoperative positions, and the work piece rotation is stopped. The chuck 13 may be of the well known diaphragm type wherein the chuck jaws 15 are opened and closed under control of a fluid pressure cylinder 20, the fluid pressure in this cylinder being regulated by a valve 21 operated by a hand lever 22. To initially locate the chuck in its required work holding position, the work head 10 is longitudinally positioned on a cross slide 23 by an adjustment screw 24, and an adjustment screw 25 transversely positions this slide on the top of the base 11, the work head and cross slide being fastened in their adjusted positions by studs.

A table 28, secured to the front of the base and vertically adjusted by a screw 29, has a horizontal bed 32 through which extends a vertical sleeve 33 as shown in Figure 4. A pair of bearings, as ball bearings 34 mounted on this sleeve, are spaced apart by a tubular member. A collar 36, mounted over the sleeve 33 and seated on the bed

32, supports the lower bearing 34, the upper bearing being engaged by a head on the sleeve, and a nut 37 on this sleeve clamps against the table to fasten the sleeve and bearings in position. A support member 40, pivotally carried coaxially of the sleeve 33 by the bearings 34, has a table portion 42 provided with a pair of ears 43 that rotatably support a horizontal shaft 44. A laterally projecting arm 45 has a rearward end fitted between these ears and secured as by a pin to the shaft 44 for pivotal movement therewith. A spindle 47 extends through a housing 48 on the forward end of the arm 45 and is mounted in housing bearings. One or more lapping wheels 17, as required, are secured on the spindle 47 which is rotated by a spindle pulley 52 belt-driven from a pulley 53 on a reduction drive unit 54 attached to a motor 55 that is mounted on the table portion 42.

A handle 56 on the arm 45 provides a convenient means for swinging the support member 40 to position the lapping wheels upon the raceways, and a latch bar, to be later described, limits the swinging of the support member during the lapping operation. A coiled spring 57, lightly tensioned between a table bracket 58 and the support member 40, swings the support member and lapping wheels away from the work piece to an inoperative position against a stop screw 59 when the latch bar is released from latched engagement. If desired, the spring 57 may be eliminated and the machine may be slightly tilted so that the arm 45 will swing outwardly under the influence of gravity. A coiled spring 60, surrounding a vertical post projecting from the table portion 42, presses upwardly against the forked end of a lever 62, fastened to the shaft 44, to urge the arm 45 downwardly and apply the lapping wheels 17 against the raceways 16 with desired light yieldable pressure. For some lapping operations, this spring may be removed since the weight of the pivoted arm 45 and associated parts may be sufficient to apply the required lapping pressure.

The lapping wheels 17, which are of a convenient size to be laterally swung into and out of the work piece, are transversely curved to conform to the transverse raceway curvatures and are preferably made of a yieldable material such as a hard felt that may be charged with an abrasive compound, such as finely comminuted abrasive grains intimately mixed with a suitable lubricant. Figure 6 illustrates the mounting for a single lapping wheel wherein a flanged stud, threaded in the end of the spindle 47, supports a wedge-shaped washer 63 against which the lapping wheel 17 is demountably secured by a clamping flange 64 so that the geometric axis of the lapping wheel 17 is angularly disposed to the axis of spindle rotation. Figure 7 shows a pair of duplicate lapping wheels 17 clamped by a nut and by wedge-shaped washers 65 on a stud demountably fastened on the end of the spindle 47. To assure that both lapping wheels of Figure 7 will simultaneously remain in lapping engagement with both raceways 16, the washers 65 are rotatably positioned so that the geometric axes of these lapping wheels and the axis of spindle rotation will lie in a common plane. The lapping wheels, which preferably are rotated much slower than the speed of the work piece rotation and in an opposite direction, rotate with a wabbling movement back and forth across the transversely curved raceways causing an up and down rocking movement of the lapping arm 45. The yieldable character of each lapping wheel provides for a small area of the lapping wheel periphery to generally conform with the work surface being lapped so that minute surface irregularities remaining from a grinding operation will be removed while this lapping operation produces the final required raceway finish.

A flange 68, on the member 40 and closely overlying the bed 32, is provided with a radial notch 69 to loosely receive a latch bar 70 vertically slidable through the bed 32 and in a bracket 71 secured to the underside of the bed. A coiled spring 72, in the bracket 71, urges the latch bar upwardly towards latching position. The radial notch 69 is sufficiently larger in size than the end of the latch bar 70 which it receives so that the support member 40 may swing slightly during the lapping operation to assure that each lap 17 will properly seat against its raceway 16. The engagement of the latch bar within this notch also limits the extent of swinging of the support member so that the pull of the spring 57 cannot swing the laps out of raceway engagement during the lapping operation. A lever 73, pivoted at one end to a bracket on the table 28, and extending through slots in the bracket 71 and in the latch bar 70, has its other end forked at 74 and straddling a rod 75 vertically slidable in the sleeve 33. A collar 76 fastened to this rod is engageable with the forked end 74 to shift the lever 73 downwardly and withdraw the latch bar from latching position. A roller 77 engageable with the underside of the lever 73 and journalled upon a pin in the latch bar 70, facilitates movement of the latch bar under control of the lever 73. A lever 78, journalled on a table bracket 80, has a rearwardly disposed arm extending through a slot in the upper end of the rod 75 and engaged by rollers carried in this slot by the rod 75, and a short forwardly extending arm of the lever 78 terminates in a cam 82 that is engageable with a roller on the lower end of a lever 83 whose upper end is fastened to the shaft 44. A coiled spring 84, compressed between a nut on the upper end of the rod 75 and a bracket 85, normally yieldably supports the rod 75 in its top position which is determined by the engagement of the collar 76 against the nut 37. When the rod 75 is in its top position and the lapping wheels 17 are swung out of the work piece W, the cam 82 is at its lowest position and engages the roller on the lever 83 to vertically locate the arm 45. During a lapping operation, the engagement of the lapping wheels upon the work piece W supports the arm 45 in a raised position causing the roller on lever 83 to lie out of cam engagement so that the arm 45 may freely swing up and down as the lapping wheels move back and forth across the raceways with a wabbling rotation. The movement of the rod 75 to its top position also retracts the collar 76 from the forked lever end 74 so that the spring 72 will urge the latch bar 70 against the flange 68 and into latched position when the support member 40 is swung to a position for the lapping operation.

A solenoid 86, mounted on a table bracket 87, has a vertically movable armature 88 fastened to the rod 75. When this solenoid is energized, the armature causes a downward movement of the rod 75 which swings the cam 82 into operative position and swings the arm 45 and lapping wheels upwardly and causes the collar 76 to shift the lever 73 downwardly to withdraw the latch bar 70 from the flange 68 so that the support mem-

ber 40 may be subsequently swung to shift the lapping wheels into and out of lapping position over the work piece shoulders 19.

The adjustably controlled automatic lapping cycle is regulated by electrical devices which include a magnetic switch 92 that starts and stops the chuck-driving motor 12, releases a motor brake 93 and starts the timer 18. This timer may be of standard construction wherein a self-starting electric clock mechanism has a sweep second hand 94 and an adjustable hand 95 which is manually pre-set to determine when timer switches 97, 98 are shifted from open to closed positions, these switches 97 and 98 being arranged to remain open only during the clockwise movement of the timer hand 94. Secured to the bed 32 is a normally open switch 100 which directs current to a solenoid S for closing the normally open magnetic switch 92, and a screw 101, adjustably mounted in a bracket on the pivoted support member 40 closes this switch 100 only when the support member is swung to a position for locating the lapping wheels in engagement with the raceways 16. A normally open switch 102, mounted on the bed 32, controls the operation of the solenoid 86, and a shoe 103 on the support member 40 shifts this switch 102 to a closed position during the final movement of the support member towards the work piece and during the initial movement of the support member from the work piece to lift the lapping wheels 17 over the shoulders 19 adjacent to the raceways 16.

In operation, a switch 106 is closed causing current flow from one side of a powerline 107 through a wire 108 to one terminal of the motor 55 which drives the lapping wheels, the other motor terminal being connected to the power line through a wire 109. The switch 106 is normally left closed so that the motor 55 runs continuously, this switch being opened to stop this motor at the end of a work shift or when the machine is to remain idle for a considerable period. Prior to a lapping operation, the arm 45 and lapping wheels 17 are usually located at their outwardly swung positions as shown in the dot dash lines of Figure 5. In the event that these parts have been swung inwardly to their operating positions, they will again swing outwardly to inoperative positions in response to a light pressure on the top of the rod 75 which releases the latch bar 70 from latched position.

A work piece W is placed in the chuck 13 which has its jaws opened and closed by the operation of the lever 22. The operator now uses the handle 56 to swing the support member 40 around its axis to carry the lapping wheels into the work piece. Just before these lapping wheels enter the work piece, the switch 102 is closed by the shoe 103 to make circuit from the wire 109, through the closed timer switch 97, wire 110 and wire 112 to energize the solenoid 86 which is also connected to the power line 107 by a wire 113. The solenoid armature 88 shifts the rod 75 downwardly causing the lapping wheels to be lifted above the shoulders 19 during their final swinging movement. As the support member 40 reaches its final position, the screw 101 closes the switch 100 causing current flow through this switch and a wire 115 to energize the solenoid S which is also connected to the power-line 107 by a wire 116. The engagement of the adjustment screw 101 with the switch 100 also serves as a mechanical stop to limit the swing of the lapping wheels into the work piece. The solenoid S now shifts the normally opened switches of the magnetic switch 92 to their closed circuit positions causing current flow from the power line 107 through a wire 118 to start the timer 18 which is also connected to this power line through the wire 113. The starting of the timer 18 opens both timer switches 97 and 98. The switch 97 now breaks current flow through the solenoid 86 so that the spring 84 lifts the rod 75 to lower the lapping wheels onto the raceways 16 and withdraws the collar 76 from the lever 73 so that the latch bar 70 latches within the notch 69 in the flange 68 and limits the swinging movement of the support member 40 during the ensuing lapping operation. Simultaneously with the start of the timer 18 the magnetic switch 92 also causes current from a power line 119 to release the motor brake 93 and start the motor 12 which produces the rotation of the work piece W. The lapping wheels now move back and forth across the transversely curved raceways with a wabbling rotation while the free up and down movement of the arm 45 maintains these lapping wheels in continuous raceway engagement.

When the timer hand 94 reaches the preset position of the hand 95, both timer switches 97 and 98 are again closed. Current now flows through the wire 109, switch 97, wire 110, switch 102 and wires 112, 113 to again energize the solenoid 86 causing a lifting of the lapping wheels out of the raceways and above the shoulders 19 immediately followed by release of the latch bar 70 from latching position as caused by engagement of the collar 76 with the lever 73 whereupon the support member 40 swings to its inoperative position away from the work piece as shown in dot dash lines in Figure 5. As the pivoted support member 40 thus swings the lapping wheels 17 over the shoulders 19, the screw 101 retracts from the switch 100 which shifts to open position and breaks circuit to the solenoid S causing the magnetic switch 92 to return to open circuit position for disconnecting current flow to the timer 18 and to the motor 12 and permitting the brake 93 to rapidly stop the motor 12 which stops rotation of the work piece W. The closing of the timer switch 98 resets the timer hand 94 to its zero starting position. When the lapping wheels have swung past the work piece W, the shoe 103 opens the switch 102 causing a de-energizing of the solenoid 86 after which the spring 84 lifts the rod 75 to lower the cam 82, arm 45 and lapping wheels. The lever 22 is shifted to open the chuck jaws. The finished work piece W is removed from the chuck, and the machine is again ready to produce a duplicate automatic lapping cycle.

We claim:

1. In a machine for lapping the grooved circular raceway on a rotating work piece, mechanism to rotate the work piece about a fixed axis, a rotatable spindle, a lapping wheel engageable with said raceway and secured to said spindle with the geometric lapping wheel axis angularly disposed to the axis of spindle rotation for wabbling rotation of said lapping wheel, and means providing for a free generally axial movement of the work piece and the spindle one relative to the other so that the lapping wheel will locate itself in said grooved raceway.

2. In a machine for lapping the grooved circular raceway on a rotating work piece, mechanism to rotate the work piece about a fixed axis, a rotatable spindle, a lapping wheel engageable with said raceway and secured to said spindle with the geometric axis of the lapping wheel an-

gularly disposed to the axis of spindle rotation for wabbling rotation of the lapping wheel, and supporting means providing for free endwise and transverse spindle movements during the lapping operation so that the wabbling lapping wheel will locate itself within said raceway.

3. In a machine for lapping the grooved raceway on a rotating work piece, a lap, means providing for a relative swinging movement between the lap and the work piece substantially axially of the work piece, and mechanism responsive to said swinging movement for relatively shifting the lap and the work piece transversely of said swinging movement to bring the lap and the raceway into contact.

4. In a machine for lapping the grooved circular raceway on a rotating work piece, a lap, means providing for a relative movement between the lap and the work piece substantially axially of the work piece, and mechanism co-operating with said movement for imparting a relative swinging movement between the lap and the work piece to bring the lap and the raceway into engagement with each other.

5. In a machine for lapping the grooved circular raceway of a rotating work piece, a lap, means providing for a relative swinging movement between the lap and the work piece to bring the lap and the work piece into proximity, and mechanism coacting with said swinging movement for imparting an additional relative movement between the lap and the work piece in another direction from that of said swinging movement to bring the lap and the raceway into engagement with each other.

6. In a machine for lapping the circular raceway on a rotating work piece, a lap, a support member mounted to swing the lap towards and from the work piece, and mechanism responsive to said swinging of the lap for additionally moving the lap transversely of said swinging movement to enable the lap to be moved past that portion of the work piece adjacent to said raceway.

7. In a machine for lapping the grooved circular raceway of a work piece having a shoulder at the side of the raceway, means to rotate the work piece about the axis of the raceway, a lap, a pivoted support member, and means for moving the lap past said shoulder and into raceway lapping engagement by a movement compounded of a swinging of the pivoted support member around one axis and an accompanying movement of the lap about another axis carried by the pivoted support member.

8. In a machine for lapping the grooved circular raceway on a rotating work piece, a lap, means providing for a relative swinging movement between the lap and the work piece to bring the lap and the work piece into proximity, mechanism responsive to the swinging movement for imparting an additional relative movement between the lap and the work piece transversely of said swinging movement to bring the lap and the raceway into contact without elsewhere contacting the lap and the work piece, and means limiting said swinging movement while the lap and raceway remain in contact with each other.

9. In a machine for lapping the grooved circular raceway on a work piece having a shoulder at the side of the raceway, means to rotate the work piece, a lap, a pivoted support member arranged to swing and transport the lap towards and from the work piece, an arm supporting the lap and mounted to move transversely of the support member movement, and mechanism responsive to the swinging of the support member for moving the arm to enable the lap to be brought past the shoulder and into raceway engagement.

10. In a machine for lapping the grooved circular raceway of a work piece having a shoulder at the side of the raceway, means to rotate the work piece about a fixed axis, a lapping wheel arranged for yieldable engagement with the raceway, means to drive the lapping wheel with a wabbling rotation causing lateral movement of the lapping wheel across the raceway, a movable support member, and mechanism for shifting the lapping wheel past said shoulder and into raceway engagement by a movement compounded of a movement of the support member generally in one direction and an accompanying movement of the lapping wheel in another direction.

11. In a machine for lapping the grooved raceway on a rotating work piece, a lap, means providing for a relative movement between the lap and the work piece to bring the lap and work piece into proximity, and electrically actuated mechanism responsive to said movement for relatively shifting the lap and the work piece transversely of said first mentioned movement to bring the lap and raceway into contact.

12. In a machine for lapping the grooved raceway on a rotating work piece, a lap, a movable support member for shifting the lap into proximity with the work piece, an arm carrying the lap and movable on the support member in a direction transversely of the support member movement, and electrical mechanism responsive to the movement of the support member for moving said arm to carry the lap into raceway engagement.

13. In a machine for lapping the grooved raceway on a rotating work piece, a lap, a spindle supporting the lap for a wabbling rotation, means providing for a relative movement between the spindle and the work piece to bring the lap and the work piece into proximity, mechanism responsive to said movement for relatively shifting the spindle and the work piece transversely of said movement to bring the lap into raceway-supported engagement, and means causing the lap and the raceway to separate at the end of a predetermined time of engagement of the lap with the raceway.

14. In a machine for lapping the grooved raceway on a rotating work piece, a lap, means providing for a relative movement between the lap and the work piece to bring the lap and the work piece into proximity, mechanism responsive to said movement for relatively shifting the lap and the work piece transversely of said movement to bring the lap and the raceway into engagement for a lapping operation, a timing device, means responsive to said movement for placing the timing device in control of the lapping operation, and timing device controlled mechanism for stopping the lapping operation.

15. In a machine for lapping the circular grooved raceway within a rotating work piece, a lap for lapping the raceway, means providing for a relative movement of the lap and the work piece substantially axially of the work piece to locate the lap within the work piece, mechanism responsive to said movement for relatively shifting the lap and the work piece transversely of said movement to bring the lap and the raceway into engagement for a lapping operation, a timing device, mechanism responsive to said movement for placing the timing device in control of the lapping operation at the start of the lapping

operation, and timing device controlled means for causing the lap and raceway to separate at the end of a predetermined lapping time.

16. In a machine for lapping the grooved raceway on a rotatable work piece, a lap, means providing for a relative movement between the lap and the work piece to bring the lap and the work piece into proximity, mechanism responsive to said movement for relatively shifting the lap and the work piece to bring the lap and the raceway into engagement for a lapping operation, means responsive to said relative movement for starting the work piece rotation, a timing device, and timing device controlled mechanism for terminating the lapping operation.

17. In a machine for lapping the grooved circular raceway on a rotatable work piece, a lap, means providing for a relative movement between the lap and the work piece to bring the lap and the work piece into proximity, a timing device, means responsive to said movement for relatively shifting the lap and the work piece transversely of said movement to bring the lap and the raceway into engagement for a lapping operation, mechanism controlled by said movement for starting the work piece rotation and for placing the timing device in control of the lapping operation, and timing device controlled means for stopping the lapping operation.

18. In a machine for lapping the grooved raceway on a rotatable work piece, a lap, means providing for a relative approach and recession between the lap and the work piece to bring the lap and the work piece into and out of proximity, mechanism responsive to the said relative approach for relatively shifting the lap and the work piece to bring the lap and the raceway into engagement for a lapping operation, means responsive to said relative approach for starting the work piece rotation when the lap and work piece enter into proximity and responsive to said relative recession for stopping the work piece rotation when the lap and the work piece are relatively moved out of proximity, and a timing device for causing separation of the lap and work piece to terminate the lapping operation at the end of a predetermined lapping time.

19. In a machine for lapping the grooved raceway on a rotatable work piece, means to rotate the work piece, a lap for lapping the raceway, means providing for a relative movement between the lap and the work piece to bring the lap and the work piece into proximity, a timing device for regulating the extent of lapping time, mechanism responsive to said movement for relatively shifting the lap and the work piece transversely of said movement to bring the lap and the raceway into engagement for a lapping operation and for placing the timing device in control of the lapping operation, and timing device controlled means for causing the lap and the work piece to separate and causing the work piece to stop rotating.

20. In a machine for lapping the grooved raceway on a rotating work piece, a lap for lapping the raceway, means providing for relative approach and recession movements between the lap and the work piece for bringing the lap and the work piece into and out of proximity, mechanism for relatively shifting the lap and the work piece transversely of said movement to bring the lap and the raceway into lapping engagement, a timing device for regulating the lapping time, and timing device controlled means for causing a separation of the lap and the work piece and for causing said recession movement to bring the lap and the work piece out of proximity.

21. In a machine for lapping the grooved raceway on a rotating work piece, a lap for lapping the raceway, means providing for relative approach and recession movements between the lap and the work piece for bringing the lap and the work piece into and out of proximity, mechanism responsive to said approach movement for relatively shifting the lap and work piece transversely of said movement to bring the lap and the raceway into lapping engagement, a timing device, means responsive to said approach movement for placing the timing device in control of the lapping operation, and timing device controlled means causing said lap and work piece to separate followed by a relative movement of the lap and work piece out of proximity with each other and causing the work piece to stop rotating.

22. In a machine for lapping the grooved raceway on a rotatable work piece, a lap for lapping the raceway, means providing for relative approach and recession movements between the lap and the work piece generally axially of the work piece to bring the lap and the work piece into and out of proximity, a timing device for regulating the lapping time, mechanism responsive to said relative approach movement for starting the work piece rotation and for starting the timing device and for relatively shifting the lap and the work piece transversely of said approach movement to bring the lap and the raceway into lapping engagement, and mechanism responsive to the timing device for causing a separation of the lap and the raceway and causing the work piece rotation to stop and causing said recession movement to relatively locate the lap and work piece remotely from each other.

23. In a machine for lapping an arcuate raceway on a circular work piece, means for rotating the work piece on its axis, a spindle substantially parallel to said axis and mounted to shift freely substantially endwise during a lapping operation, a lapping wheel fixed on the spindle in a tilted position and having a transversely rounded periphery engageable with said raceway, means to rotate the spindle causing the lapping wheel to move back and forth across the raceway with a wabbling rotation, and mechanism for urging the lapping wheel against the raceway.

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