April 6, 1943. G. F. JOHNSON 2,316,071

LAPPING MACHINE

Filed May 23, 1941 2 Sheets-Sheet 1

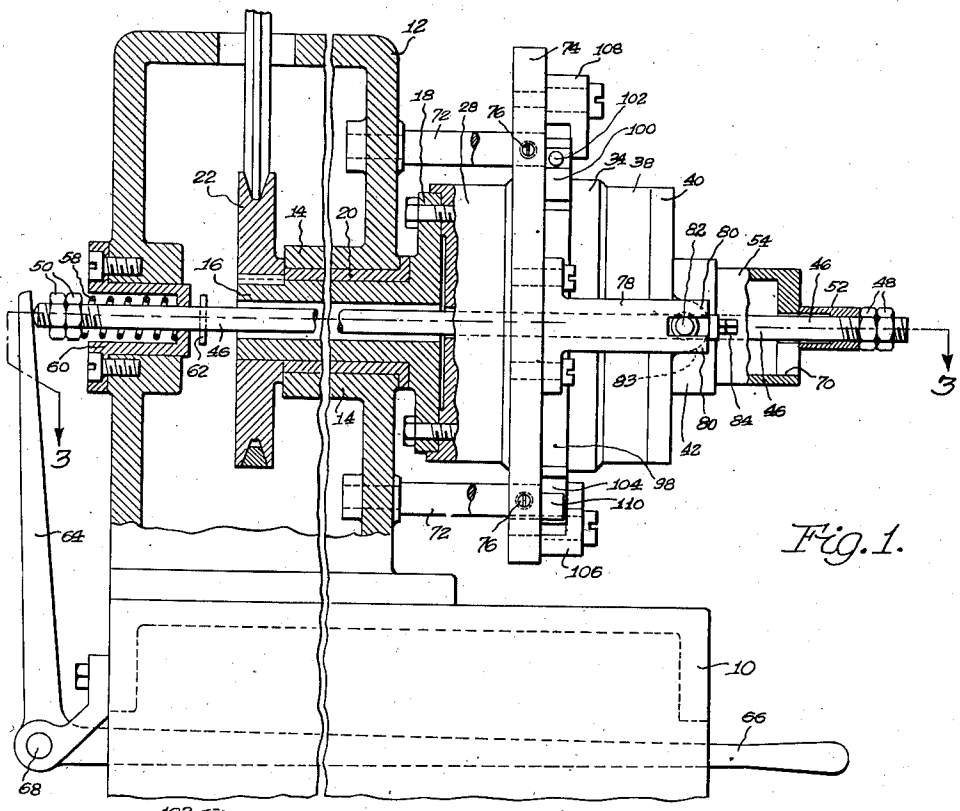


Fig. 1.

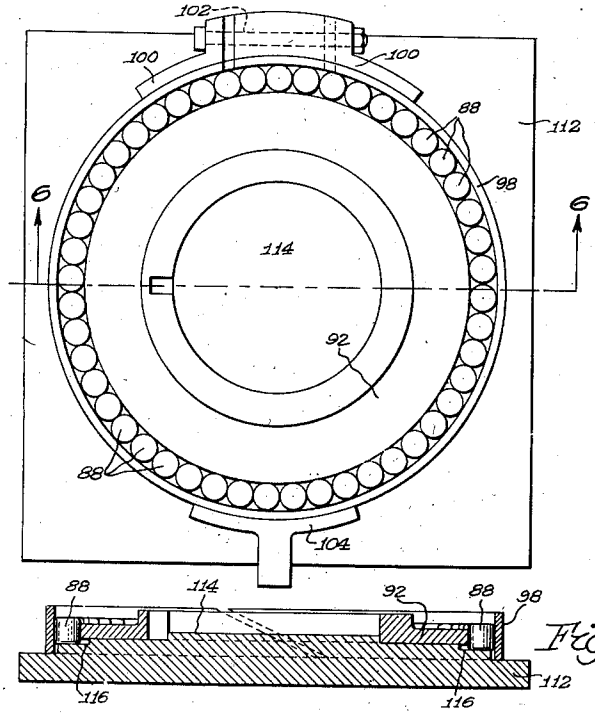


Fig. 5.

Fig. 6.

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Filed May 23, 1941 2 Sheets-Sheet 2

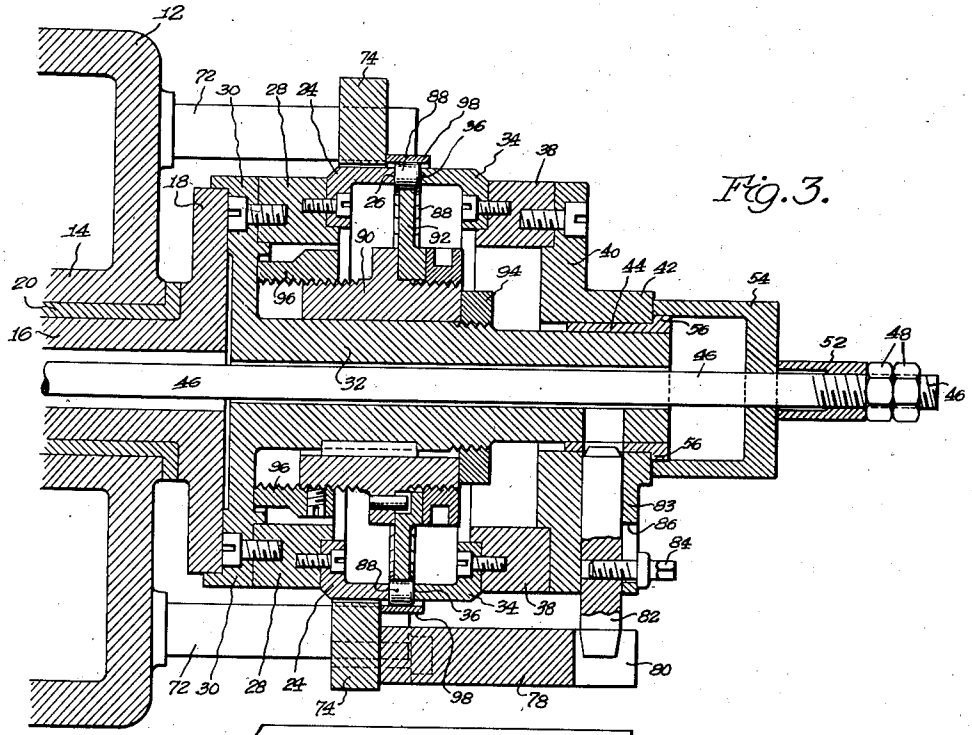


Fig. 3.

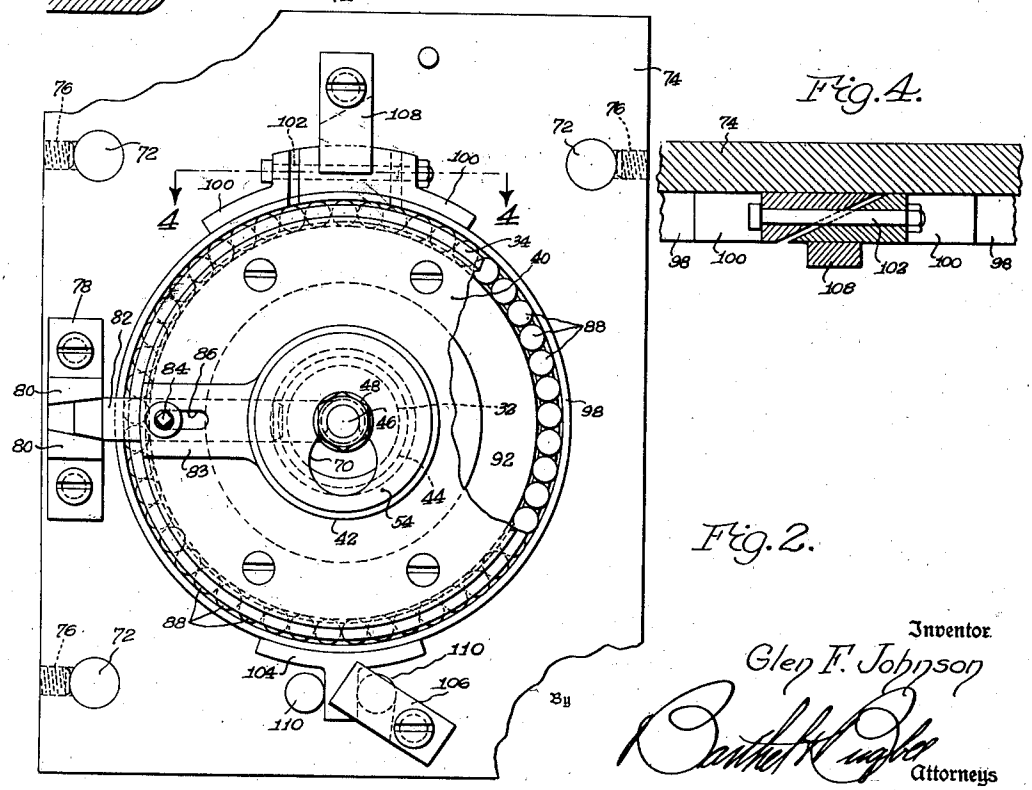


Fig. 4.

Fig. 2.

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Patented Apr. 6, 1943

2,316,071

UNITED STATES PATENT OFFICE

2,316,071

LAPPING MACHINE

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Application May 23, 1941, Serial No. 394,864

11 Claims. (Cl. 51—118)

This invention relates, in general, to lapping machines and, in particular, to those of the type adapted for lapping the end surfaces of roller bearing members.

One of the objects of the present invention is to provide a new and improved lapping machine wherein the vital parts thereof are so arranged and related as to be more easily assembled and disassembled than heretofore.

Another object is to provide a new and improved lapping machine wherein the work-charging process is performed more easily than heretofore.

Another object is to provide a new and improved lapping machine in which the lap surfaces may be rotated together or relatively one to the other, whichever is desired.

Another object is to provide a new and improved lapping machine wherein the proper lapping pressure is more easily and readily established and accurately maintained from operation to operation than heretofore.

Another object is to provide a new and improved machine for lapping the end surfaces of roller bearing members which is compactly arranged, efficiently operable and productive of accurate and highly finished results.

Other objects and advantages of the invention will become readily apparent from a reference to the following specification taken in conjunction with the accompanying drawings of which there are two (2) sheets and wherein:

Figure 1 is an elevational view of the machine and is partly broken away and in section to illustrate more clearly some of the details of the construction thereat;

Figure 2 is an elevational view looking at the right end of Figure 1;

Figure 3 is a section taken along the lines 3—3 in Figure 1;

Figure 4 is a section taken along the lines 4—4 in Figure 2;

Figure 5 is a plan view of the structure employed in assembling the work-carrying device of the machine; and

Figure 6 is a section taken along the lines 6—6 in Figure 5.

Referring to the drawings, the machine comprises a base 10 from which extends a casing 12 having a side wall formed with a hollow boss 14, said boss rotatably supporting the sleeve portion 16 of a mandrel consisting also of a flange portion 18 residing externally of said casing, said boss and said sleeve portion preferably accommodating a bearing 20 therebetween. Mandrel 16—18 is rotated about its axis responsive to the operation of power means (not shown) associated in any well known manner with a drive 22 fixed to the inner end of sleeve 16 of said mandrel.

A lap member 24 formed with an annular lap surface 26 is fixed to flange 18 of mandrel 16—18 for rotation therewith through an intermediate ring member 28 and the flange portion 30 of another mandrel consisting also of a sleeve portion 32 extending in an opposite direction to sleeve 16 of said mandrel 16—18 and in coaxial alignment therewith, said lap surface being concentric with respect to the common axis of said mandrels and residing in a plane normal thereto.

Employable in cooperation with the aforedescribed lap device having the rotatable lap surface 26 is a lap member 34 which is formed with an annular lap surface 36, this latter surface being arranged in spaced, opposed relation to the former surface and in similarly concentric and normal relation to the common axis of mandrels 16—18 and 32—30 by means of the fixed attachment of said lap member 34 to a ring member 38 which in turn is fixed to the flange portion 40 of another mandrel consisting also of a sleeve portion 42. Lap unit 36—34—38—40—42 is made adaptable for slidable movement toward and from the other lap unit by the free supporting of the former about the free end of sleeve 32 of the latter, there being a bushing 44 arranged between said free end of said sleeve 32 and sleeve 42 and secured to the latter for movement therewith.

It is proposed that the lap device having lap surface 36 be constantly constrained or biased toward the lap device having lap surface 26 in order to provide the pressure necessary for the lapping operation, and it is also proposed that the former device be capable of being removed from its support, namely, sleeve 32 of the latter device, at the end of said operation in order that the machine may be re-charged with work for the next operation. For these reasons, an actuator 46, in the form of a rod, is supported at the common axis of the two lap devices and extends, at one of its ends, outwardly beyond the free end of sleeve 32 and, at the other of its ends, outwardly beyond the wall of casing 12 which is opposite the wall providing boss 14, this first-mentioned rod end being threaded and carrying adjustable stops 48 and this second-mentioned rod end also being threaded and similarly carrying adjustable stops 50. Stops 48 may, if desired, be supplemented by an additional stop 52 carried on actuator 46 in abutment not only with said stops 48 but also with the outer face of a cup-shaped connecting member or spacer 54, said spacer be-

ing centrally bored at its bottom end so as to be slidably receivable by said actuator but abuttable by said stop 52 and so dimensioned at its opposite end as to be slidably receivable on the outer surface of a flange 56 formed about the adjacent end of bushing 44 to abut the end of sleeve 42. On the other hand, stops 50 provide an abutment for one end of a coil spring 58 which is telescopically received about actuator 46 and has its opposite end supported in abutment with the bottom wall of a cup-shaped retainer 60 carried in and secured to the wall of casing 12 adjacent the end of said actuator carrying said stops, said actuator, if desired, carrying a stop 62 between said retainer wall and drive 22 in order to limit the movement of said actuator in either direction. In driving relation with the end of actuator 46 which carries stops 50 there is supported the free, upper end of a toggle 64—66 which is pivoted to base 10, as at 68, and operated by means, such as the operator's foot, at the free, lower end thereof.

It can be seen in Figure 1 that actuator 46 is normally under constant subjection to the pressure of spring 58, this tending to bias lap surface 36 toward lap surface 26 through the intermediate agency of spacer 54. However, when it is necessary to remove finished work from the machine or to charge said machine with new work, it has been found desirable to remove the axially movable lap device in its entirety from said machine, the first step being to depress arm 66 of toggle 64—66 and thereby move actuator 46 to the right to space stop unit 48—52 from spacer 54. In this spaced condition of the stop unit and spacer, the latter may be slipped off its support 56 and, being formed with an opening 70 which is in communication with its actuator-receiving bore and of greater radial dimension than said stop unit, have said opening register with said stop unit so that said spacer may be passed therebeyond and removed in its entirety from actuator 46. Thereafter, the axially movable lap device may be removed, together with bushing 44, from sleeve 32 and thence, as well, from actuator 46.

It will be appreciated that, once the desired lapping pressure has been determined by a proper setting of the stops 48 and 50, this pressure can be maintained from operation to operation regardless of the number of removals of the removable lap device from the machine. It is clear also that the adjustability of the stops permits practically any pressure whatsoever to be obtained and maintained.

The lap device which includes lap surface 36 is not only axially movable relatively to the other lap device and selectively removable from the machine but is also selectively rotatable or nonrotatable about its central axis, which is the machine axis. To explain, the casing wall which provides boss 14 also provides a plurality of spaced, horizontally extending supports 72 upon which a vertical plate 74 is mounted, said plate being annular and residing about the lap device which includes lap surface 26 and also being preferably adjustable as to its horizontal positioning on said supports through the use of set screws 76 interconnecting said plate and said supports. Plate 74 has a bracket 78 secured thereto which resides laterally of the lap device including lap surface 36 and extends in the general direction of that end of the machine, the free end of said bracket being bifurcated, as at 80, to receive between the elements thereof the end of a pin 82. Pin 82 is slidably receivable within aligned, transverse bores provided therefor in sleeve 32, bushing 44 and an enlargement 83 in ring 40—42, and is so slid through the manipulation of a finger bolt 84 threadedly received in said pin and extending therefrom through a slot 86 provided therefor in said enlargement, said bolt being tightened in place against the adjacent face of said enlargement upon arranging said pin in its desired position. The length of pin 82 is such as to enable it to have two effective positions, one wherein the inner end of said pin resides within the bore provided therefor in sleeve 32 while the outer end is displaced from between bifurcations 80, in which position the two lap devices are unitarily rotatable, and the other wherein said inner end resides without said bore while the outer end resides between said bifurcations, in which position the device having lap surface 36 is nonrotatable. Another function of the bifurcations 80, of course, is to permit free axial movement of the axially movable lap device when pin 82 is in its outer position as well as to permit removal of said device from its support without the necessity of having to disturb said pin.

The surfaces that are to be lapped by lap surfaces 26 and 36 are the end surfaces of roller bearing members 88, and these members are to be arranged in plurality and in axial parallelism and movable about the aligned axes of said lap surfaces as well as about their own axes while in lapping contact with said lap surfaces. To attain these ends, a sleeve 90 is carried telescopically about sleeve 32 and is operatively keyed thereto for rotation therewith and axial movement therealong, said sleeve 90 having an annular plate 92 fastened thereto between the ends thereof for movement therewith but, as well, for removability therefrom. The outer periphery of plate 92 is circular and, as will soon be seen, is to provide the radially inner supporting wall surface for the side surfaces of work pieces 88. Unit 90—92 is made adjustable with respect to its axial positioning on sleeve 32 by the provision of a threaded portion on said sleeve which receives a nut 94 and of a threaded portion on sleeve 90 of said unit which receives a nut 96, said nut 94 abutting the adjacent end of said sleeve 90 and said nut 96 abutting the adjacent face of flange 30. It is clear that nuts 94 and 96 may be co-adjusted and that such adjustment effectuates axial adjustment of the aforementioned supporting wall surface on plate 92 relatively to surfaces 26 and 36, this being advantageous particularly in the event it is desired to perform work on rollers having lengths greater or lesser than those shown at 88.

To provide the necessary radially outer supporting wall surface for the side surfaces of members 88, the inner surface of a circularly formable, flexible band 98 is employed, this band having a pair of ends preferably cut along the diagonal and each of which has fixed thereto a lug 100. Lugs 100 are interjoinable by a fastener 102 to form band 98 into a circular member with practically any diameter within reasonable and/or necessary limits, the inner surface of this formed band serving as the above mentioned outer supporting surface and the diagonal formation of the ends thereof tending to minimize the gap between said ends so that members 88 may enjoy substantially unbroken travel. In addition to lugs 100, band 98 also fixedly carries another lug 104 the purpose of which is described herebelow.

It is proposed that band 98 be non-rotatable, whereas plate 92 is rotatable, and, for this reason, plate 74 is provided with a pair of pivotally supported clamping members 106 and 108 which are operable for clampingly engaging lug 104 and interjoined lugs 100 and removably holding said band in place against the adjacent face of said plate 74 and telescopically about members 88, said members 88 the while obtaining their inner support from said plate 92. If desired, lug 104 may be received between a pair of stops 110 carried by plate 74 so as to be assured that band 96 will not rotate. It can be seen that the non-rotatability of band 98, the rotatability of plate 92 and the frictional pressure established by each upon the side surfaces of members 88 all cooperate to cause said members to rotate about their own axes and the central lap axis regardless of whether the lap devices are rotating together or relatively to each other.

When the lapping operation is completed, clamps 106 and 108 are turned into inoperative positions with respect to lugs 104 and 100, lever arm 66 is depressed, spacer 54 is removed from flange 56 and its opening 70 placed in registration with stop unit 48—52 so that said spacer may be slid past said unit and off actuator 46. Thereupon, bushing 44—56 and unit 42—40—38—34—36 are unitarily removed from the machine by sliding same off sleeve 32 past the adjacent end of actuator 46 and its stop unit 48—52. It is then possible to remove nut 94 from sleeve 32, whereupon the elements 96, 90—92, 88 and unit 98—100—102—104 may be unitarily removed from the machine. This process is reversed, of course, after the work-carrying unit has been re-charged with work and it is desired to repeat the lapping operation thereupon.

Reference to Figures 5 and 6 shows the manner and structure employed in the charging of the work-carrying device with work. As displayed, a plate 112 is employed for the purpose of supporting plate 92 in a fixed position thereon while work 88 and band 98 are inter-assembled with said latter plate, said plate 112 having a boss 114 which is registrable with the central opening in said plate 92 to hold the latter in said position. Plate 112 also has a ledge 116 upon which the ends of members 88 may rest and at the same time have their side surfaces arranged in contact with the peripheral supporting surface of plate 92 with said last mentioned surface preferably equi-distant from said ends. While plate 92 and members 88 are so co-arranged, band 98 may be placed on its side on plate 112 about said members and its ends tightened together by fastener 102 until the desired tension is obtained, that is, a tension which will produce a frictional force between plate 92, members 88 and band 98 sufficient to cause rotation of said members about their axes and the axis of the assembly during relative rotation of said band and last mentioned plate.

Although the invention has been described with some detail it is to be understood that such description is for the purpose of illustration only and is not to be taken as definitive of the limits of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as will fall within the purview of the attached claims.

What I claim is:

1. In a lapping machine, rotatable means providing an annular lap surface, normally non-rotatable means providing another annular lap surface spaced from and in opposed relation to said first-named lap surface, means providing an annular wall surface, means providing another annular wall surface spaced from and in opposed relation to said first-named wall surface, the space defined between said lap surfaces and said wall surfaces being adapted for confining work therewithin, and a latch carried by said normally non-rotatable lap surface means adapted to releasably and alternately engage one of said wall surface means and said first named means operable selectively for effectuating rotation of said second-named means, with said first-mentioned means and non-rotation with said wall surface means.

2. In a machine for lapping the end surfaces of roller bearing members comprising, a pair of lap devices formed to provide opposed, annular lap surfaces and at least one of which devices is rotatable, a pair of supports carried on opposite sides of said lap surfaces and at least one of which supports is rotatable, and a pair of members carried by said supports and formed to provide opposed, annular supporting surfaces operable for frictionally contacting the side surfaces of bearing members while the end surfaces of the latter are in lapping contact with said lap surfaces, one of said surface-forming members comprising a flexible band having complementary biased ends interconnectible in different positions to provide a continuous uninterrupted wall surface and to permit a variable distance between its supporting surface and that of said other surface-forming member, and said other annular member being adjustable in its support relative to the axis thereof.

3. In a machine for lapping the end surfaces of roller bearing members comprising, a pair of lap devices formed to provide opposed, annular lap surfaces and at least one of which devices is rotatable while the other is normally non-rotatable, a pair of supports carried on opposite sides of said lap surfaces and at least one of which supports is rotatable, means selectively operable for interconnecting said normally non-rotatable lap device and said rotatable support to cause the former to rotate with the latter, and a pair of members carried by said supports and formed to provide opposed, annular supporting surfaces operable for frictionally contacting the side surfaces of bearing members while the end surfaces of the latter are in lapping contact with said lap surfaces.

4. In a lapping machine, a rotatable device having an annular lap surface, a normally non-rotatable device also having an annular lap surface in opposed relation to said first-named lap surface, a rotatable device having an annular supporting surface on one side of said lap surfaces, a non-rotatable device also having an annular supporting surface on the opposite side of said lap surfaces and in opposed relation to said first-named supporting surface, said lap surfaces and said supporting surfaces defining a space therebetween in which to carry work pieces with their end surfaces in lapping contact with said lap surfaces and their side surfaces in frictional contact with said supporting surfaces, and a connecting member carried by said normally non-rotatable device and selectively movable into driven connection with one of said two rotatable devices for causing said normally non-rotatable device to rotate.

5. In a lapping machine, a rotatable device

having an annular lap surface, a normally non-rotatable device also having an annular lap surface in opposed relation to said first-named lap surface, a rotatable device having an annular supporting surface on one side of said lap surfaces, a non-rotatable device also having an annular supporting surface on the opposite side of said lap surfaces and in opposed relation to said first-named supporting surface, said lap surfaces and said supporting surfaces defining a space therebetween in which to carry work pieces with their end surfaces in lapping contact with said lap surfaces and their side surfaces in frictional contact with said supporting surfaces, and an elongated connecting member carried by said normally non-rotatable device and selectively movable into one or the other of two positions, one of said positions being that wherein said connecting member interconnects said normally non-rotatable device and one of said two rotatable devices to cause rotation of said normally non-rotatable device, and the other of said positions being that wherein said connecting member interconnects said last mentioned device and said non-rotatable device to oppose rotation of said normally non-rotatable device.

6. In a lapping machine, a device having an axis of rotation and being formed with an annular lap surface and a central support both of which are movable with said device about said axis, a second device slidably carried on said support and being formed with an annular lap surface in spaced, opposed relation to said first-named lap surface, an actuator movable in opposite directions but biased in one thereof, means operatively interconnecting said actuator and said second device and responsive to the biasing of said actuator in said one direction for exerting a pressure on said second device to urge the latter along said support and move said second-named lap surface toward said first-named lap surface, and means operatively connected to said actuator for selectively moving the latter in the opposite direction to relieve said first-named means of said pressure and permit freedom of movement of said second device along said support and movement of said second-named lap surface away from said first-named lap surface.

7. In a lapping machine, a device having an axis of rotation and being formed with an annular lap surface and a central support both of which are movable with said device about said axis, a second device slidably carried on said support and being formed with an annular lap surface in spaced, opposed relation to said first-named lap surface, an actuator movable in opposite directions but biased in one thereof and having an abutment at one of its ends, a spacer member freely carried about said actuator intermediate said abutment and said second device and responsive to the biasing of said actuator in said one direction for exerting a pressure on said second device to urge said second-named lap surface toward said first-named lap surface, means operatively connected to said actuator for selectively moving the latter in the opposite direction to relieve said spacer member of said pressure and permit freedom of movement of said second-named lap surface away from said first-named lap surface, and means associated with said spacer member and registrable with said abutment to permit removal of said spacer member from said actuator.

8. In a lapping machine, a lap device, a support, a second lap device carried by said support in spaced relation to said first-named device and cooperable with the latter for lapping work pieces, pressure-exerting means, pressure-transmitting means arranged intermediate said second-named device and said first-named means for transmitting pressure from the latter to said second-named device to effectuate movement of the latter along said support toward said first-named device, and means effective for permitting displacement of said second-named means from between said first-named means and said second-named device to permit displacement of the latter from said support.

9. In a lapping machine, a pair of members defining spaced, opposed lap surfaces, another pair of members defining spaced, opposed supporting surfaces cooperable with said lap surfaces to define a space in which work is to be supported for being lapped, one of said members of said first-named pair and its surface being rotatable, a support supporting one of said members of said second-named pair and its surface for rotation, and means operatively connecting the opposite ends of said last mentioned member to said support for moving said last mentioned member along said support into a selected position therefor and maintaining same thereat.

10. In a lapping machine, means providing an annular surface member, means providing another annular lap surface member spaced from and in opposed relation to said first-named lap surface member, a disk providing an external annular wall surface, a circular guide providing an internal annular wall surface spaced from and in opposed relation to said external wall surface, the space defined between said lap surface member and said disk and circular guide wall surfaces being adapted for confining work therewithin, means effective for moving at least one of said lap surface members about its axis and at least one of said wall surfaces about its axis, and a latch bolt alternately movable and operable selectively for alternately interlocking one of said lap surface members with the other lap surface member and to the circular guide.

11. In a machine for lapping the end surfaces of roller bearing members comprising a pair of lap devices formed to provide opposed, annular lap surfaces and at least one of which devices is rotatable, a pair of supports carried on opposite sides of said lap surfaces and at least one of which supports is rotatable, a pair of members carried by said supports and formed to provide opposed inner and outer annular supporting surfaces operable for frictionally contacting the side surfaces of bearing members while the end surfaces of the latter are in lapping contact with said lap surfaces, and a latch member alternately and selectively operable for alternately interconnecting said lap devices for rotation and one of said lap devices with the outer supporting member for non-rotation.

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