

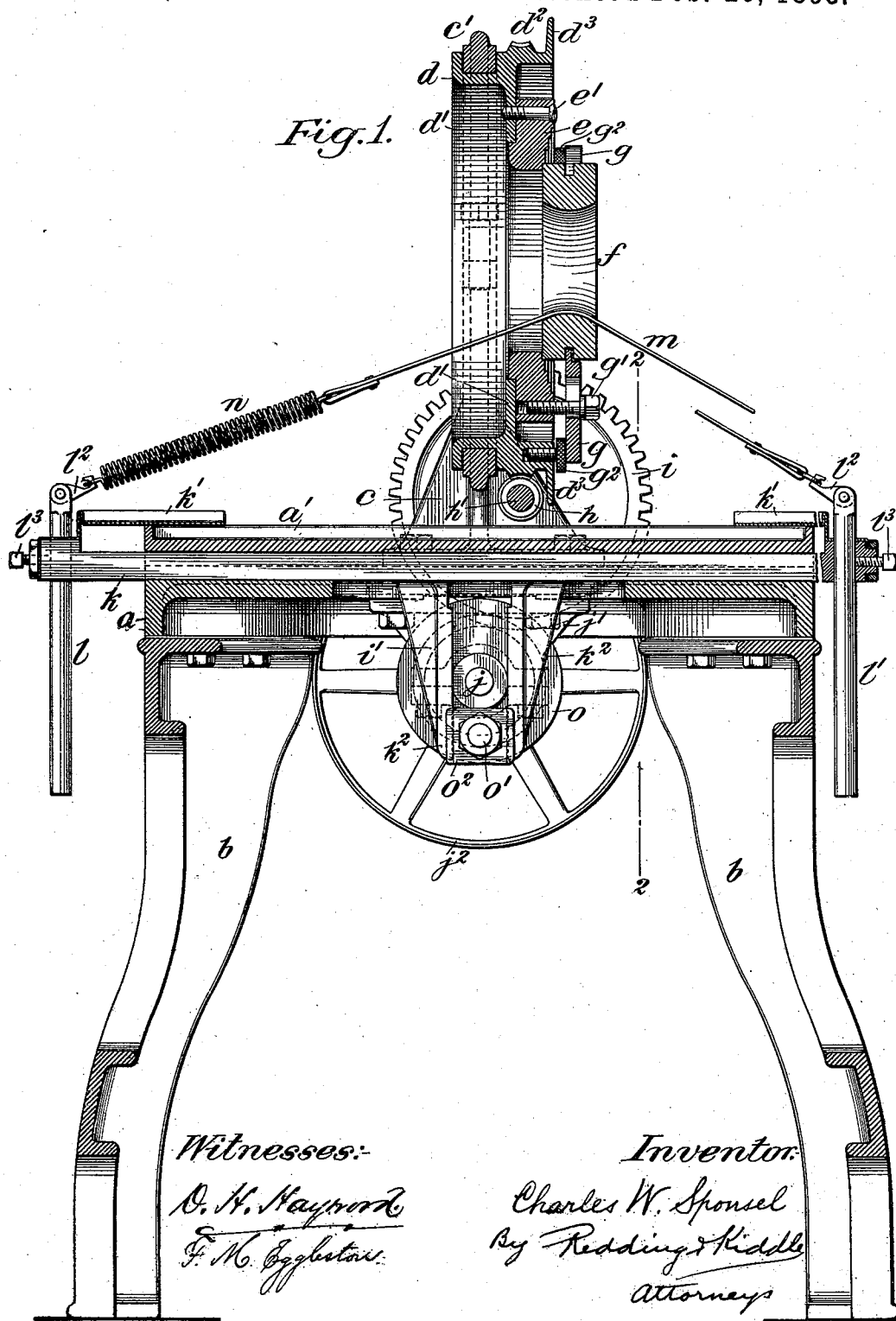
(No Model.)

3 Sheets—Sheet 1.

C. W. SPONSEL.  
POLISHING OR LAPPING MACHINE.

No. 534,767.

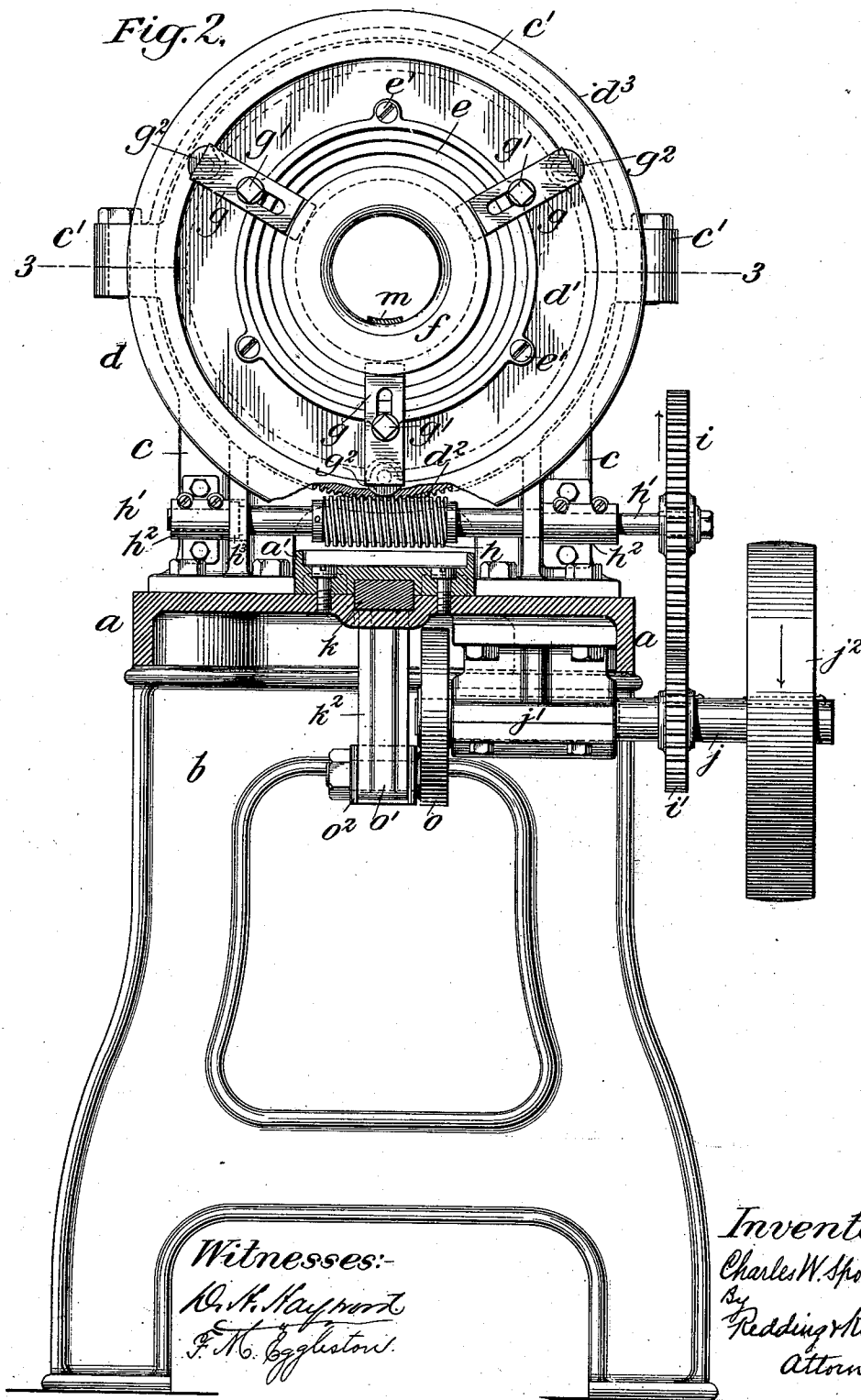
Patented Feb. 26, 1895.



C. W. SPONSEL.  
POLISHING OR LAPPING MACHINE.

No. 534,767.

Patented Feb. 26, 1895.



(No Model.)

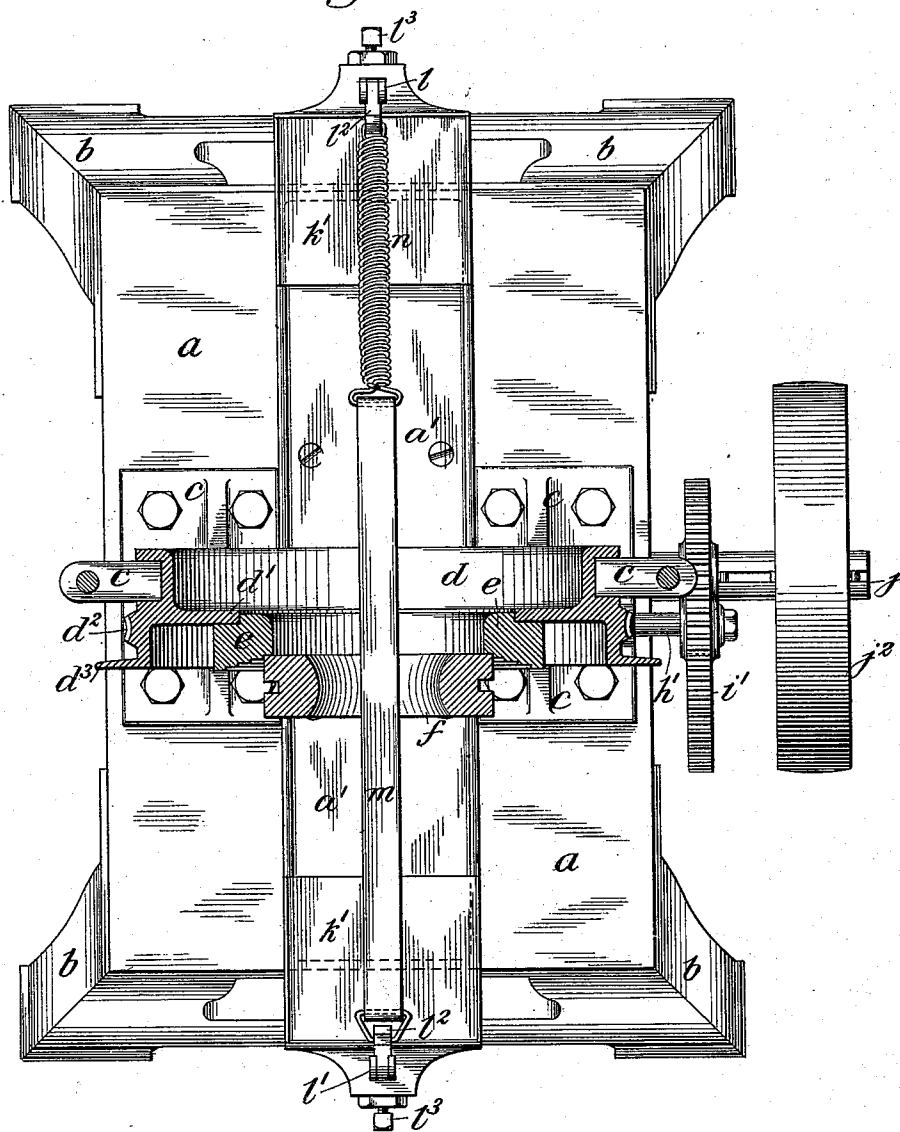
3 Sheets—Sheet 3.

C. W. SPONSEL.  
POLISHING OR LAPPING MACHINE.

No. 534,767.

Patented Feb. 26, 1895.

*Fig. 3,*



*Witnesses:-*

*R. H. Maynard*  
*F. M. Eggleston*

*Inventor:-*

*Charles W. Sponsel*  
*By Redding & Kiddle*  
*Attorneys.*

# UNITED STATES PATENT OFFICE.

CHARLES W. SPONSEL, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE POPE MANUFACTURING COMPANY, OF SAME PLACE AND PORTLAND, MAINE.

## POLISHING OR LAPPING MACHINE.

SPECIFICATION forming part of Letters Patent No. 534,767, dated February 26, 1895.

Application filed November 24, 1894. Serial No. 529,805. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES W. SPONSEL, a citizen of the United States, and a resident of the city and county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Polishing or Lapping Machines, of which the following is a specification, reference being had to the accompanying drawings, forming part hereof.

10 This invention relates to polishing or lapping machines or apparatus, and the machine embodying this invention as herein described is particularly adapted for polishing or lapping the inner surfaces of hollow metal articles.

15 According to my invention the article to be polished is held in a rotating head or chuck, and a rapidly moving flexible polishing device such as a strap or belt or band works in contact with the inner surface of the article. Thus the rotation of the article constantly brings fresh surfaces under the polishing strap, and a uniform polishing action is insured around the entire inner periphery of the article.

20 According to my invention improved means are provided for holding the articles in the rotating chuck or head, and for holding articles of different sizes therein, and for holding the polishing device and adjusting it to work upon articles of different sizes and shapes, and for actuating said parts; and the invention also includes various improvements in details of construction as will be hereinafter fully described and claimed.

25 The accompanying drawings illustrate an embodiment of my invention.

30 Figure 1 is a vertical longitudinal central section of such a polishing or lapping machine. Fig. 2 is an end view of the same with the frame cut in section on the line 2—2, Fig. 1, and with the head partly broken away to show its actuating worm. Fig. 3 is a plan view of the machine showing the head in section on the line 3—3, Fig. 2.

35 The frame of the machine may be of any usual and suitable construction and the main parts of this frame are shown as consisting of a bed *a* supported upon legs *b b*. Upon the bed *a* is supported the standard *c* provided with a suitable cap *c'* bolted thereto, and this

standard and cap form the bearing for the rotating head *d*, which head holds or is provided with means for holding the article to be polished. The head *d* is shown as having 55 a projecting flange on one side, the left side in Fig. 1, which flange bears against the face of the standard *c* and cap *c'* and covers and shields the joint between the head and its bearing so that the emery or other polishing 60 or grinding powder employed with the polishing device will not enter between the parts; and the head *d* also bears against the right face of the standard and cap, and thus the head is firmly held against longitudinal move- 65 ment while its free rotation within its bearing is permitted.

The rotating head *d* is provided with an inwardly extending flange *d'* of annular form and the face plate or holding block *e*, also of 70 annular form, is shown as held by screws *e'* against the face of said flange *d'*, said holding block being shouldered against said flange, although in some constructions said face plate instead of being a separate piece 75 may be in one piece with the head, and the outer face of said holding block (shown at the right in Fig. 1 and in front in Fig. 2) is provided with a series of annular steps, said steps being of dimensions corresponding to 80 the different sizes of articles designed to be held by the block *e*. If the machine were designed to be used for articles of a single size, but one step or groove would be necessary, and if the machine were to hold articles of 85 substantially different form from that shown, its gripping surface or steps could be altered accordingly.

40 The article *f* to be polished, is shown as hollow and ring-shaped and with a convex 90 inner periphery, and of the smallest diameter that the holding block or face plate *e* is designed to hold, and this article fits within and is centered by the cylindrical or slightly conical edge of the step of smallest diameter on 95 said face plate. The article *f* is held against said face plate by dogs *g*, three of which are shown, and the article *f* is shown as provided with a circumferential groove into which the ends of said dogs project, and each dog *g* is 100 held by a pivot bolt or screw *g'* entering the face plate *e*, said bolt passing through a slot

in said dog, and the head of the screw bearing against the outer face of said dog, and the outer end of each dog is pressed away from the face plate and thereby its inner end  
 5 pressed toward the face plate by a clamping screw  $g^2$  entering a threaded hole in the head  $d$ . It is of course evident that where the article is not grooved to receive the dogs  $g$  the dogs may press against the outer face or other  
 10 suitable part of the article, but by the engagement of the dogs in a groove in the article the construction is more compact and the dogs and screws are shielded from the emery or polishing powder that may be employed  
 15 with the polishing strap, and are out of the way of the polishing strap. The desired degree of adjustability as to the diameters of the articles is provided by the slot in each dog  $g$ , while the pivot and clamping screws  
 20 may be moved toward and from the face plate to accommodate other variations in the size or shape of the article. In some constructions embodying or partly embodying my invention it may be desirable to employ other  
 25 means than above described for holding the article, such for instance as any suitable and known form of chuck.

A worm wheel  $d^2$  is shown as integral with the rotating head  $d$ , and this worm wheel  $d^2$   
 30 meshes into a worm  $h$  upon the shaft  $h'$  said shaft being fitted to rotate in bearing boxes  $h^2$   $h^3$  secured to the standard  $c$ . A flange  $d^3$  of the head  $d$  projects outwardly a sufficient distance to cover and shield the worm  $h$ , so that  
 35 emery or other polishing powder employed on the polishing strap will not be deposited upon the worm. The worm  $h$  is also beneath the head  $d$  and is shielded thereby from polishing powder falling from the polishing strap.  
 40 The worm  $h$  is shown as pinned upon its shaft, and against the left hand bearing  $h^2$  of said shaft a thrust collar  $h^3$  bears, and the bearing boxes  $h$  have split bearings, but it is of course evident that these details of construction may be modified without departing  
 45 from my invention, and the worm  $h$  may be integral with its shaft, and the worm wheel  $d^2$  may be formed in a separate ring or wheel secured upon the head  $d$ .

The worm  $h$  through the worm wheel  $d^2$  actuates the head  $d$  so as to cause it to rotate slowly to present fresh surfaces to the polishing device. A spur gear wheel  $i$  is mounted upon said shaft  $h'$  and meshes into another  
 55 spur gear wheel or pinion  $i'$  upon the driving shaft  $j$ , said driving shaft  $j$  having bearings in a block or standard  $j'$  secured to the bed  $a$  at the lower face thereof and projecting downwardly therefrom. It is evident that in other  
 60 constructions embodying my invention the details of connecting gears and bearing boxes may be varied from those shown. The driving shaft  $j$  is shown as arranged to be driven through a pulley  $j^2$  upon the outer end of  
 65 said driving shaft.

The polishing device is carried by a slide  $k$  shown as of rectangular form and arranged

to move in a direction parallel to the axis of rotation of the head and extending from end to end of the machine and projecting at each  
 70 end beyond the bed plate  $a$ . This slide  $k$  is shown in middle position in which position it extends beyond the bed plate at about an equal distance at each end, but in Fig. 1 the  
 75 right hand end of the slide is partly broken away. A suitable guideway is formed in the bed  $a$  for the slide  $k$  and a cap  $a'$  for the same is secured by bolts to the bed plate and covers  
 80 the slide from end to end of the bed  $a$ , the standard  $c$  which supports the head being arched over and clear of this cap, and this cap  $a'$  also acts as a pan to receive superfluous  
 85 grinding powder or other material that is dropped from the polishing strap during the polishing operation, and to this end the upper surface of the cap  $a'$  has a depressed surface surrounded by a rim or wall. To shield the  
 90 portions of the slide  $k$  that extend out beyond the cap  $a'$  I provide aprons  $k' k'$  which are secured to the ends of the slide  $k$  and extend inwardly a sufficient distance to at all times overlap the cap  $a'$  or cover the projecting  
 95 ends of the slide. These aprons  $k'$  are shown as of sheet metal and secured to the ends of the slide  $k$  by means of clamping nuts screwed over studs formed on said slide and  
 100 their upper parts may be in the shape of pans as shown or may be flat or otherwise shaped so as to cover and shield the projecting ends of the slide  $k$ .

The means for directly holding the polishing strap consist of the two adjustable rods  $l$ ,  $l'$  extending vertically through the enlarged  
 105 ends of the slide  $k$  and provided at their upper ends with pivoted hooks  $l^2 l^2$  or other suitable devices for grasping the ends of the polishing device or strap. The rods  $l$  and  $l'$  are held in desired positions by the set screws  $l^3$   
 110  $l^3$  and when said set screws are loosened the rods may be moved to bring the hooks  $l^2$  into any desired vertical positions, and the rods may be tightly clamped by the set screws in  
 115 such positions. The polishing strap  $m$  may be of any suitable flexible material, such as leather, raw hide, &c., and is provided with a suitable tension device which is shown as consisting of a spiral or helical spring  $n$  interposed at some point between the hooks  $l^2$  and  
 120  $l^2$ , whereby the strap is pulled with a yielding tension against the face upon which it is desired to exert its polishing action. As shown in the drawings this face constituting the inner periphery of the article  $f$  is of considerable  
 125 convexity, and the rods  $l$  and  $l'$  have been lowered so that the direction of tension upon the ends of the polishing device will cause the polishing strap to following the circular contour of the inner periphery of the article  $f$ , and thus exert its polishing action  
 130 on all portions of said inner periphery. It is of course evident that the desired yielding tension may be applied to the polishing device or strap by other forms of springs or by weights or other devices, but the construction

shown employing a spiral spring subjected to extensional strains is well adapted to the high speed at which this part of the machine is actuated.

5 For the purpose of actuating the slide *k*, a crank disk *o* is formed or secured upon the end of the driving shaft *j*, and this crank disk *o* has formed upon or secured to it a crank pin *o'*, and this crank pin *o'* actuates the slide  
10 *k* through intervening devices consisting of the sliding block *o<sup>2</sup>* fitted to rotate on said crank pin *o'* and to reciprocate within a slide-way or bearing upon the slide *k*, said slide-way being formed by the inner faces of two  
15 downwardly extending arms or pedestals *k<sup>2</sup>*. By reason of this construction every full revolution of the driving shaft *j* causes a full reciprocation of the slide *k* and thus causes the polishing strap to move backward and forward  
20 over the surface to be polished, and the comparatively long stroke of the crank pin causes a considerable surface of the polishing strap to be brought into operation, and the variable movement imparted to the slide  
25 *k* causes a desirable variable speed of movement of the polishing strap in contact with the surface to be polished, and the reciprocation of these devices occurs without sudden jars or shocks.

30 It will be noted that by reason of the very large diameter of the worm wheel *d<sup>2</sup>* upon the head *d*, the rotative movement of said head *d* will be performed very slowly, one revolution of the worm shaft *h'* representing only  
35 a progression rotatively of the head *d* equal to one tooth of the worm wheel. The gearing connecting the driving shaft *j* and the worm shaft *h'* may also be constructed as shown so as to produce a slower rotative speed  
40 of the worm shaft *h'* than of the driving shaft *j* and thus the driving shaft *j* may be rotated at comparatively high speed so as to cause a rapid rubbing movement of the polishing strap, while the head carrying the article to  
45 be polished will very slowly and uniformly rotate so as to slowly bring fresh surfaces under the operation of the polishing strap and thus cause uniform polishing action upon the inner periphery of the article.

50 In the use of the polishing device it is frequently desirable to employ emery or other suitable polishing or grinding powder and a considerable amount of this polishing powder will necessarily be dropped from the belt  
55 during the operation of the machine, but as has been before described, the machine is so constructed that the various moving parts and bearings will be shielded from this emery or polishing powder, while a receptacle is provided comprising the pan formed in the cap  
60 *a'* whereby said polishing powder may be collected and held so as to be again used, and thus the waste of the polishing powder is prevented as well as its interference with the  
65 moving parts of the machine.

From the above description the operation of my improved polishing or lapping machine

will be readily understood. When the machine is not in use the polishing strap is not usually connected with the rods *l* and *l'* or is  
70 connected with only one of them. After the article to be polished has been clamped in the head the polishing strap *m* is passed through the article and is connected with the holding rods *l*, *l'*, and the desired adjustment  
75 is made of said rods for holding the strap so that the strap will be in proper contact with the surface to be polished, and also to regulate the tension of said strap. It is of course evident that suitable means may be provided  
80 for adjusting the length of the polishing device or strap independently of the adjustment of said rods *l*, *l'*, although such means have not heretofore been found necessary.

The polishing powder, if any is to be used, 85 having been placed upon the strap or surface to be polished, the parts of the machine are now ready for the polishing operation which operation is performed automatically, requiring the intervention of an operator only for  
90 starting the machine at the beginning of the polishing operation and for stopping the machine at the conclusion thereof, and in some cases for occasionally renewing the polishing powder during the operation. 95

It is of course evident that various modifications may be made of the structure above described in the use and application of my invention, and that parts of my invention may be used separately and in combination with  
100 other parts of different construction. I do not therefore limit myself to the specific embodiment of my invention hereinabove particularly described and shown in the drawings; but 105

What I claim, and desire to secure by Letters Patent, is—

1. In a lapping or polishing machine, the combination with means for holding and rotating a hollow article, of a flexible polishing  
110 device adapted to operate upon the inner periphery of said article and a reciprocating holder for the same, substantially as set forth.

2. In a lapping or polishing machine the combination with a rotating head adapted to hold the article to be polished, of a polishing  
115 device, a reciprocating holder for said polishing device, said holder being movable in the general direction of the axis of rotation of said rotating head, and means for actuating  
120 said holder whereby the polishing device is caused to reciprocate in contact with the article, substantially as set forth.

3. In a lapping or polishing machine the combination with means for holding the article to be polished, of a reciprocating slide,  
125 two adjustable rods upon said slide, and a flexible polishing device held at one end by one of said rods and at the other end by the other of said rods, substantially as set forth. 130

4. In a lapping or polishing machine, the combination with a rotating head provided with means for holding the article to be polished, of a reciprocating slide, a polishing

strap and means for connecting said polishing strap with a yielding tension to said slide, substantially as set forth.

5 The combination with a rotating head provided with a centering step, of clamping dogs adapted to press an article against said head and into said step, adjustable pivot screws entering said dogs, and adjusting screws adapted to press outwardly against the outer ends of said dogs, substantially as set forth.

6. The combination with a head fitted to rotate and provided with means for holding an article to be polished, of a worm wheel upon said head, an actuating worm meshing with said worm wheel, said head covering said worm and having a projecting flange extending over said worm, and means for moving a polishing strap in contact with an article held in said head, substantially as set forth.

7. The combination with the head *d* provided with the face plate *e*, said face plate having a series of annular steps thereon, of the slotted dogs *g*, the pivot screws *g'*, and the clamping screws *g*<sup>2</sup>, substantially as set forth.

8. In a lapping or polishing machine, the combination with means for holding the article to be polished, of a reciprocating slide, and a flexible polishing strap and means for connecting each end of said polishing strap to said slide, said means including a yielding tension device, substantially as set forth.

9. The combination of a reciprocating slide, a polishing device carried thereby, a frame and guideway for the slide including a cover for the slide, and aprons secured to the ends of said slide and extending inward and overlapping said cover of the frame, substantially as set forth.

10. The combination of the slide *k*, the adjustable rods *l* and *l'* upon said slide *k*, a flexible polishing device held at one end by the rod *l* and at the other end by the rod *l'*, and a driving shaft and crank pin thereon and means for imparting the reciprocating movement of said crank pin to said slide, substantially as set forth.

11. The combination with the head *d*, a bearing in which said head is fitted to rotate, said head being provided with a flange extending over and shielding said bearing, an an-

nular face plate *e* on said head and means for holding a hollow article to be polished against said face plate, means for rotating said head, said head being provided with a flange extending over and shielding said rotating means, and means for moving a polishing device in contact with an article held by said head, substantially as set forth.

12. The combination with the head *d*, a bearing in which said head is fitted to rotate, said head being provided with a flange extending over and shielding said bearing, an annular face plate *e* on said head and means for holding a hollow article to be polished against said face plate, means for rotating said head, said head being provided with a flange extending over and shielding said rotating means, the slide *k*, the adjustable rods *l* and *l'* upon said slide, a flexible polishing device including a yielding tension device held at one end by the rod *l* and at the other end by the rod *l'*, a driving shaft and crank pin thereon, and means for imparting the reciprocating movement of said crank pin to said slide, substantially as set forth.

13. The combination with the head *d*, a bearing in which said head is fitted to rotate, said head being provided with a flange extending over and shielding said bearing, an annular face plate *e* on said head and means for holding a hollow article to be polished against said face plate, a worm wheel upon said head, an actuating worm meshing with said worm wheel, said head covering said worm and being provided with a projecting flange extending over and shielding said worm, the slide *k*, the adjustable rods *l* and *l'* upon said slide, a flexible polishing device including a yielding tension device held at one end by the rod *l* and at the other end by the rod *l'*, a driving shaft and crank pin thereon and means for imparting the reciprocating movement of said crank pin to said slide, and gearing connecting said driving shaft and worm, substantially as set forth.

This specification signed and witnessed this 19th day of November, A. D. 1894.

CHARLES W. SPONSEL.

In presence of—

ELON B. NOBLES,  
WILBUR C. JOHNSON.