April 2, 1940. H. W. DUNBAR ET AL 2,196,108

POLISHING MACHINE

Filed Aug. 13, 1937

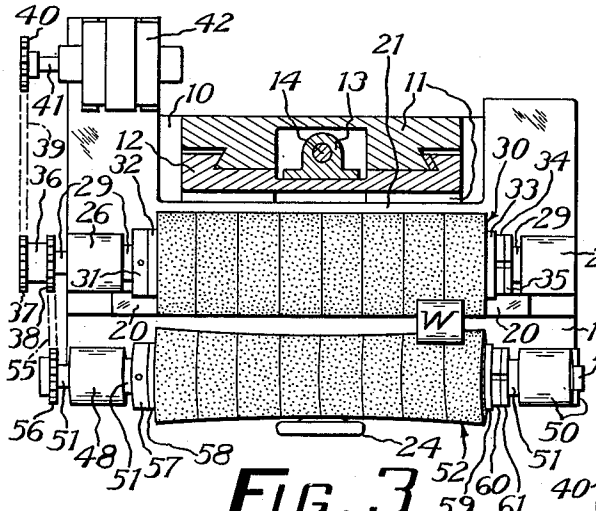


FIG. 3

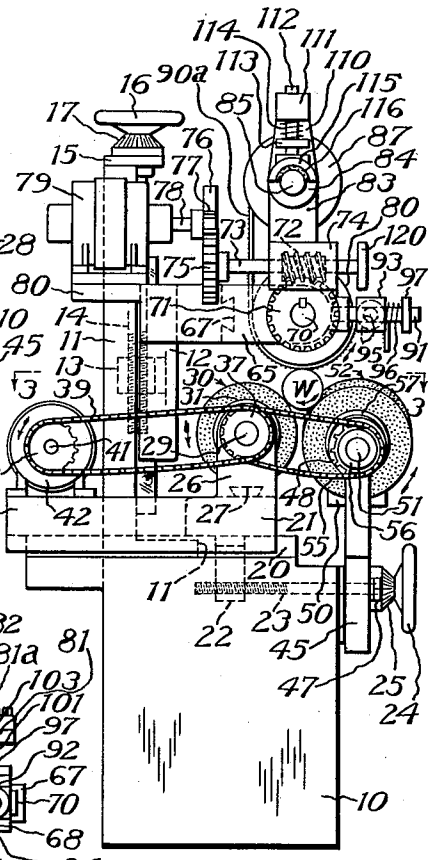


FIG. 2

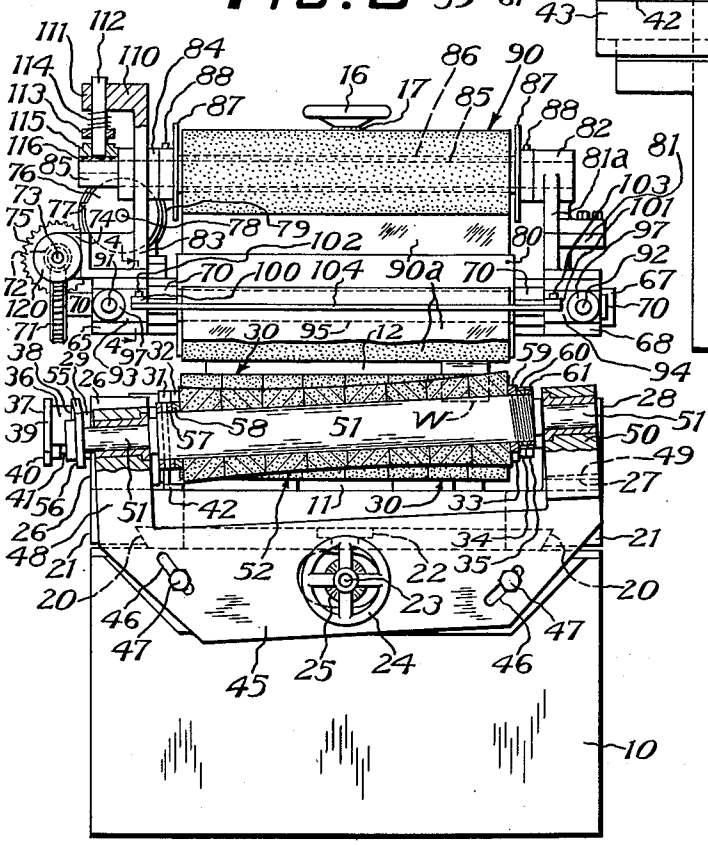


FIG. 1

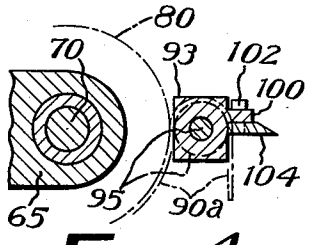


FIG. 4

Inventors

HOWARD W. DUNBAR

HERBERT S. INDGE

By George Crompton Jr.

Attorney

Patented Apr. 2, 1940

2,196,108

UNITED STATES PATENT OFFICE

2,196,108

POLISHING MACHINE

Howard W. Dunbar, Worcester, and Herbert S. Indge, Westboro, Mass., assignors to Norton Company, Worcester, Mass., a corporation of Massachusetts

Application August 13, 1937, Serial No. 158,969

1 Claim. (Cl. 51—154)

The invention relates to abrading machines and with regard to its more specific features to polishing machines.

One object of the invention is to provide a through feed polishing machine. Another object of the invention is to provide a machine for polishing small cylindrical objects such as rolls and the like. Another object of the invention is to provide a machine of high capacity production for polishing cylindrical objects. Another object of the invention is to provide an abrading machine of such character that the abrasive action can be readily varied. Another object of the invention is to provide a polishing or lapping machine requiring no dressing or truing of any parts. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combination of elements, and arrangements of parts as will be indicated in the structure to be hereinafter described, and the scope of the application of which will be pointed out in the following claim.

In the drawing illustrating one of many possible embodiments of the mechanical features of this invention,

Figure 1 is a view partly in vertical section and partly in front elevation of a machine constructed in accordance with the invention;

Figure 2 is an end elevation;

Figure 3 is a horizontal sectional view taken on the line 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary sectional view taken on the line 4—4 of Figure 1.

Referring first to Figures 1, 2 and 3, we provide a machine base 10 having at the rear thereof an uprising column 11. A vertical slide 12 has a nut 13 affixed to it through which passes a screw shaft 14 that is journalled in a thrust journal 15 at the top of the column 11. A hand wheel 16 is secured to the upper end of the screw shaft 14 and by means thereof the operator can raise and lower the slide 12. A dial 17 may be provided to assist the operator in locating the slide 12.

Referring to Figures 1 and 2, the base 10 has on the upper side thereof ways 20 supporting for movement in a horizontal plane a slide 21. Depending from the slide 21 is a nut 22 through which passes a screw shaft 23 extending to the front of the machine and having affixed thereon a hand wheel 24. By rotating the hand wheel 24 the slide 21 may be moved forwardly or rearwardly of the machine frame 10. A dial 25 similar to the dial 17 may be provided to assist the operator in his calculations.

Referring now to Figure 1, uprising from the left hand side of the slide 21 is a journal portion 26. Referring to Figures 1 and 2, on the right hand side of the slide 21 as it is viewed in Figure 1 are dove-tailed ways 27. A journal member 28 having dove-tailed ways complementary to the ways 27 fits upon these ways 27 and uprises from the right hand end of the slide 21. Referring now to Figure 3, the journal members 26 and 28 journal a shaft 29 upon which is mounted an abrasive cylinder 30. The abrasive cylinder 30 is preferably made of a plurality of cylindrical abrasive members mounted in axial alignment as shown. The abrasive members making up the cylinder 30 may consist of any one of the usual abrasives, such as silicon carbide, silica or fused alumina, and preferably the latter is used. The abrasive particles may be bonded with any one of the usual or known bonds including vitrified clay and other ceramic bonds, natural resins such as shellac, synthetic resins, rubber, and other types. The phenolic condensation product resin gives many practical advantages in a machine of this class. Suitable flanges and nuts 31, 32, 33, 34 and 35 may be used to mount the wheel 30 upon the shaft 29. For assembly purposes the left hand end of the shaft 29 is first placed in the journal member 26 and then the journal member 28 may be slid into position.

Still referring to Figure 3, fastened to the shaft 29 is a double sprocket member 36 having sprocket gear portions 37 and 38. A chain 39 connects the sprocket gear 37 with a sprocket gear 40 fastened to the armature shaft 41 of a motor 42. The motor 42, as best shown in Figure 2, is secured to a rearwardly extending portion 43 of the slide 21.

Referring now to Figures 1 and 2, mounted on the front of the machine is an angularly adjustable supporting member 45. The member 45 has arcuate slots 46, 46 through which extend bolts 47, 47, the bolts extending into the machine frame 10 and serving to lock the supporting member 45 to the machine frame. Extending upwardly from the left hand side of the supporting member 45 as viewed in Figure 1 is a journal portion 48. On the right hand side of the supporting member 45 are ways 49 similar to the ways 27. A journal member 50 has dove-tailed ways on the bottom thereof which are complementary to the ways 49, and the member 50 fits upon these ways and uprises from the right hand end of the supporting member 45.

The journal members 48 and 50 journal a shaft 51 upon which is mounted a pseudosphere 52. This pseudosphere may be made up of a plurality of abrasive members mounted in axial alignment as shown, and these abrasive members may be of the same type as those which make up the cylinder 30. On the other hand, however, the cylinder 30 as well as the pseudosphere 52 may be a solid piece of steel or cast iron, or only the pseudosphere 52 may be of metal. It is contemplated that this machine will preferably function without the use of any dressing device or the like. Accordingly the member 52, whether a composite member made of many abrasive sections or a solid abrasive member or a solid piece of steel or cast iron, or of any other form, is preferably shaped outside of the machine into pseudospherical form or shape, which is defined as that shape which will receive in tangent relation a cylindrical work piece and along which the cylindrical work piece may be pushed while maintaining the condition of tangency. Sufficiently accurate results in the manufacture of such shapes can now be achieved so that the finished pseudosphere may be placed in the machine of the present invention where it will perform its work for a long time before requiring reshaping. As shown in the drawing, the pseudospherical member 52 is inclined to the horizontal while the wheel 30 has its axis in a horizontal plane. This results in a feeding component upon a work piece as the two wheels are rotated in the direction of the arrows as shown in Figure 1. The exact pseudospherical shape adopted depends upon the angle of skew, and the angle of skew having been predetermined, the member 52 is shaped accordingly. However, errors in manufacture may be substantially compensated for by the adjustment of the supporting member 45 between the bolts 47 and the long slots 46.

The pseudospherical member 52 which, the same as the cylindrical member 30 is a work holding and rotating member, is positively driven by means of a chain 55 passing around the sprocket 38 and around a sprocket 56 secured to the shaft 51. The pseudospherical member 52 is mounted upon shaft 51 by means of flanges and nuts 57, 58, 59, 60, and 61 and the shaft 51 is placed in its journals in the same manner in which is placed the shaft 29. A work piece W introduced at the left hand end of the machine is supported by the members 30 and 52, rotated by them, and propelled to the right, Figure 1, by the skewed supporting member 52. For the polishing of different sizes of work pieces the supporting cylinder 30 may be moved horizontally to different positions by turning the hand wheel 24.

Referring now to Figure 1, projecting forwardly from the left hand side of the slide 12 is a journal support 65. Similarly projecting forwardly from the right hand side of the slide 12 is a portion thereof having dove-tailed ways 67 for holding a journal member 68. Extending between the journal members 65 and 68 and supported thereby is a shaft 70 to the left hand end of which is attached a worm wheel 71. Meshing with the worm wheel 71 is a worm 72 mounted on a shaft 73 which is journalled in a bracket 74 attached to the journal member 65. Referring now to Figures 1 and 2, attached to the rear end of the shaft 73 is a gear 75. A wheel 76 having a single tooth 77 is mounted adjacent the gear 75 in such position that the tooth 77 will engage the gear 75 to drive it one tooth at a time. The wheel 76 is mounted on the armature shaft 78 of a motor 79 which is supported by a bracket 32 formed integral with the slide 12. At every revolution of the motor shaft 78 the gear 75 is moved by the distance of one tooth which, by way of the reduction gear involving the worm 72 and worm wheel 71 slowly and intermittently revolves the shaft 70. Secured to the shaft 70 is a cylinder 80, for example a hollow cast iron cylinder. Extending upwardly from the journal support 68 is a bracket 81 removably supporting a bracket 81a having a journal portion 82. Extending upwardly from the journal portion 65 is a bracket 83 having a journal portion 84. A shaft 85 extends between the journal portions 82 and 84. A let-off drum 86 which may be made of wood has suitable flanges 87 and is mounted upon and secured as by set screws 88 to the shaft 85. A roll of sandpaper 90 is wound upon the let-off drum 86 and the sandpaper 90a as shown in Figure 2 extends downwardly and around the cylinder 80.

Referring now to Figures 1 and 2, extending forwardly from journal members 65 and 68 are studs 91 and 92. Mounted on these studs 91 and 92 are journal members 93 and 94 supporting a small cross roller 95 located in front of the cylinder 80. Springs 96 located on the studs 91 and 92 and backed up by collars 97 urge the journals 93 and 94 rearwardly of the machine thus pressing the roller 95 toward the cylinder 80. The sandpaper 90a extends half way around the cylinder 80 and between the cylinder 80 and the roller 95, then half way around the roller 95 where it hangs downwardly.

Referring now to Figures 1, 2 and 4, extending forwardly from the journals 93 and 94 are bosses 100 and 101. By means of bolts 102 and 103 a knife blade 104 is secured to the bosses 100 and 101. This knife blade 104 extends across and in front of the roller 95. The end of the sandpaper 90a extends downwardly between the back of the knife blade 104 and the roller 95. When this depending end becomes too long the operator simply presses the paper upwardly against the blade 104 and tears off a portion of the sandpaper which has been used and may be discarded. This clears the machine of accumulations of sandpaper.

The work piece W revolves in such direction that it pulls the sandpaper down from the drum 86. The shaft 85 is intermittently indexed in a counterclockwise direction, Figure 2. We provide braking means to prevent the let-off drum 86 from spinning and to hold the sandpaper taut. As shown in Figures 1 and 2, the bracket 83 has an upwardly extending L-shaped portion 110 providing a journal 111 for a vertically movable stud 112 having a collar 113 secured thereto. A spring 114 presses the collar 113 and therefore the stud 112 downwardly. Secured to the bottom of the stud 112 is an arcuate brake member 115 having a brake lining 116 engaging the outer end of the shaft 85. This constitutes a brake to hold the paper 90a in a taut condition and not only keeps the let-off drum 86 from spinning but also holds back the cylinder 80 by holding the paper taut. By reason of the drive and let-off described, the sandpaper is held to the cylinder 80 in a smooth condition.

The work piece W is fed through the machine from left to right (Figure 1) at the same time that it is rotated and supported by the rolls 30 and 52. The sandpaper polishes the work piece W and the abrasive surface is constantly re-

newed by the angular indexing mechanism described. The amount of pressure between the work piece and the rolls **30** and **52** and the sandpaper **90***a* may be varied by adjusting the hand wheel **16**. The hand wheel **120** secured to the shaft **73** is provided for initially setting up the machine or feeding the sandpaper more rapidly if desired.

The term "sandpaper" is used generically to include all coated abrasive materials, and the backing may be paper or cloth or other flexible material. The abrasive may be ordinary quartz sand but fused alumina abrasive is preferred. Also other abrasives might be used such as silicon carbide, garnet, or emery.

By means of this machine a very fine polish can be imparted to a cylindrical work piece such as a roll. Grinding lines are rapidly removed by passing a work piece through this machine. Since the abrasive surface is constantly renewed the machine does not have to be shut down for adjustments or for truing. Since the rolls **30** and **52** merely feed the work piece they are found to last a long time. The rolls **30** and **52** may be made of metal as aforesaid thus saving considerable in the cost thereof. However, for certain other uses of the machine, the longer lived abrasive rolls **30** and **52** will be preferred. A wide range of different sizes of work piece may be operated upon by the machine due to the various adjustments provided including the screw **14** to locate the slide **12** and the screw **23** to locate the slide **21**.

It will thus be seen that there has been provided by this invention an apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

We claim:

In apparatus of the class described a pair of driving and rotating rolls which are in skewed relation to each other, that is to say their axes are at a slight angle to each other, one of said rolls being pseudo-spherical in shape to a degree to compensate for the relative skew between the rolls in order to hold a work piece with a line contact, means for positively rotating one of said rolls, a third normally stationary roll parallel to one of the first two rolls and located to form with them a throat for polishing a work piece, a supply reel for coated abrasive material, and an intermittent drive for the third roll intermittently to feed the coated abrasive material to present further portions thereof to polish the work piece, whereby the first two rolls rotate a work piece and move it axially throughout the polishing throat and the third roll forms a backing for the abrasive to polish the work piece by rotation of the work piece in contact with the stationary coated abrasive.

HOWARD W. DUNBAR.
HERBERT S. INDGE.