Aug. 11, 1931. A. L. NELSON 1,818,085

OVAL GRINDING

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Fig. 1.

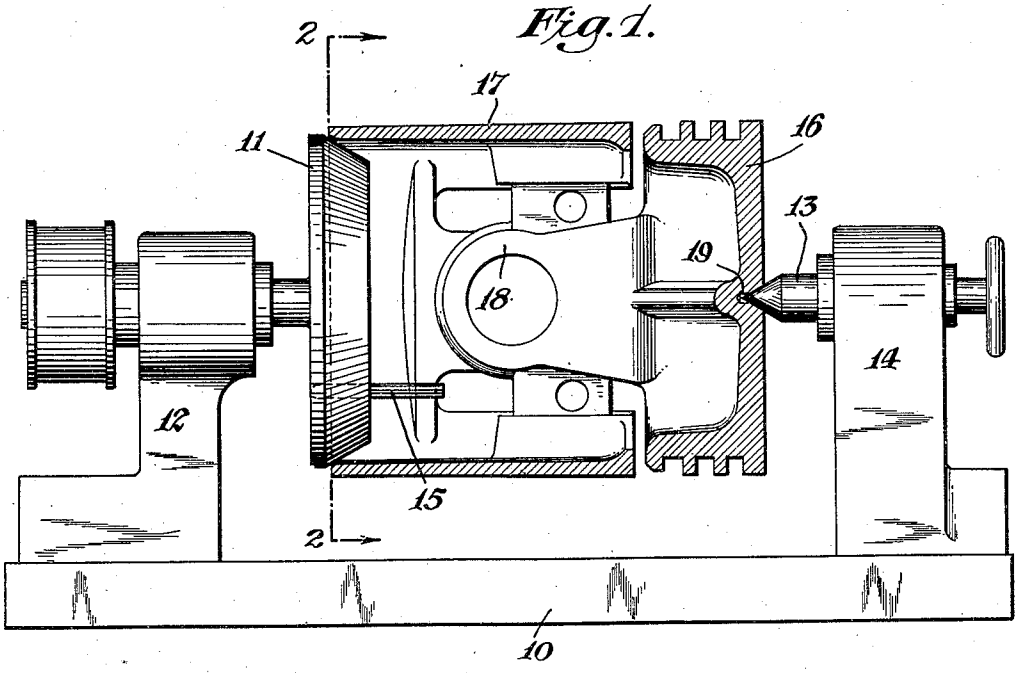


Fig. 2.

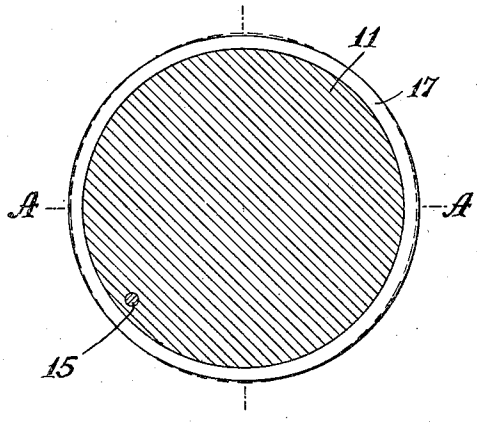
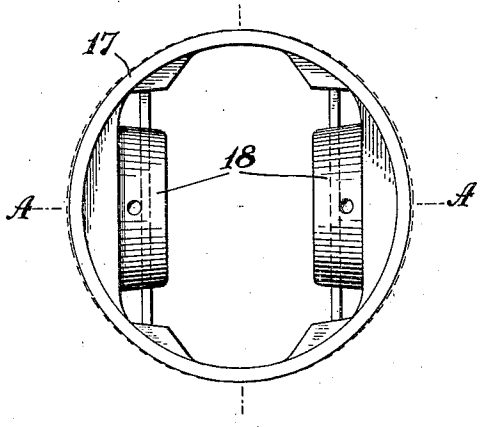


Fig. 3.



Inventor:
Adolph L. Nelson
By his Attorneys
Frank H. Hunt

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Fig. 4.

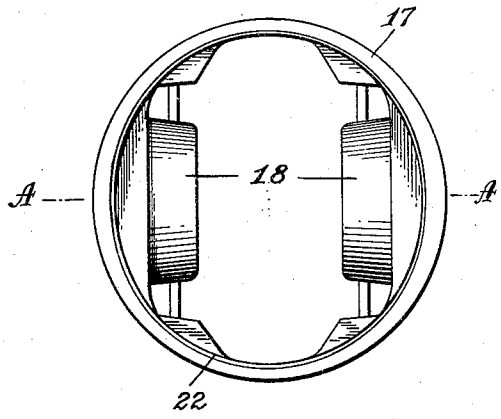


Fig. 5.

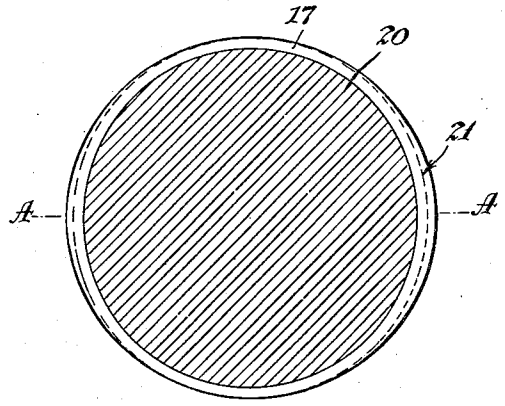
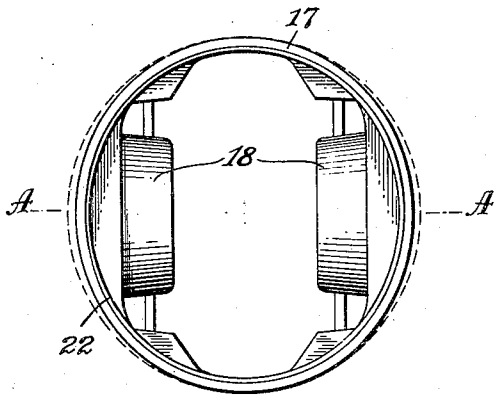


Fig. 6.



Inventor

Adolph L. Nelson

By his Attorney

Frank J. Kent

Patented Aug. 11, 1931

1,818,085

UNITED STATES PATENT OFFICE

ADOLPH L. NELSON, OF DETROIT, MICHIGAN, ASSIGNOR TO BOHN ALUMINUM & BRASS CORPORATION, OF DETROIT, MICHIGAN

OVAL GRINDING

Application filed May 5, 1928. Serial No. 275,317.

This invention relates to a method of grinding hollow articles, such as pistons.

A particular object is the provision of a simple and effective method of grinding a hollow article in such a manner as to give the finished product an oval exterior shape. The process is particularly applicable to the grinding of pistons for internal combustion engines where the open end of the piston is to be given an oval shape.

While preferred methods of carrying out the process have been disclosed herein, it will be clear that the process may be modified without departing from the spirit and scope of the invention as hereinafter set forth and claimed.

In the drawings;

Fig. 1 is an elevation of apparatus adapted to the process of the invention.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is a bottom plan of a piston treated according to the invention.

Fig. 4 is a view similar to Fig. 3 but illustrating a modified process.

Fig. 5 is a section similar to Fig. 2 but showing the method of grinding the piston of Fig. 4.

Fig. 6 is a view similar to Fig. 4 showing the result of the grinding operation.

In finish grinding the exterior surface of certain hollow cylindrical objects it is sometimes desired to grind them to a slightly oval shape. For example certain considerations of operating efficiency may make it desirable to grind the skirt of an automobile piston in such a manner as to produce a slight oval on the exterior of the skirt adjacent its open end. According to current practice this result can be obtained only by "cam grinding", a process which involves difficulties and high cost.

The process of the present invention is adapted for finishing articles of resilient material and consists broadly in first expanding the open end of the hollow cylindrical member into an oval shape, and then grinding the member in the usual manner until the exterior surface of the expanded cylinder is perfectly cylindrical. After grinding, the expanding means is released, and due to the inherent resiliency of the cylinder walls they spring back to their original position, and the parts that were expanded out beyond the normal circumference of the cylinder and lost more material in the grinding operation, now lie slightly below the normal circumference, giving the cylinder an oval exterior shape.

The drawings illustrate particularly how the invention may be applied in grinding a piston for an internal combustion engine. The reference numeral 10 indicates the table of a grinding machine, the driving center 11 being supported in a journal bracket 12 and rotated by any suitable means. The driving center 11 is made slightly oval, the amount of deviation from the normal circle being made to suit the particular circumstances, in one instance being about 0.003 in. A centering member 13 is mounted in the upper end of the bracket 14, the member 13 being spring-pressed toward the driving center 11. A driving pin 15 projects from driving center 11 for the purpose of engaging the work and causing it to maintain its original position on the driving center.

The piston comprises a head 16 and a skirt 17, and is formed with bosses 18 for the piston pin on opposite sides. In the particular example it is desired to grind the lower end of the skirt so that the part of its surface lying under the pin bosses will be reduced below the normal circumference of the skirt. This is done by placing the open end of the piston on the driving center 11 with the major axis of the driving center coinciding with the diameter A—A of the piston, which is parallel with the axis of the pin bosses. The piston is then sprung over the driving center 11 so that its lower end changes shape from the normal round circumference indicated in dotted lines in Fig. 2 to the oval shape shown in solid lines in Fig. 2. The tapered resilient holding center 13 is then engaged in a hole 19 formed in the head of the piston, the pressure of center 13 being sufficient to maintain the piston in its expanded position. The driving pin 15 engages a part of the piston and keeps the piston from slipping on the driving center.

The grinding of the skirt is now proceeded

with by means of the usual grinding tools until the exterior of the expanded piston has acquired a true cylindrical contour.

When the grinding is completed the piston is removed from the machine, and the resilient walls of the skirt spring back to their original positions, changing the external shape of the lower end to an oval with the minor axis on the diameter A—A of the piston, as shown in Fig. 3. In this figure the solid lines show how the parts of the skirt lying under the pin bosses have fallen below the normal round circumference indicated in dotted lines.

Figs. 4, 5 and 6 of the drawings illustrate another method of grinding by means of which a similar result is obtained.

In this case the conical centering hole 22 in the open end of the piston skirt, which must be machined in the open end of the piston skirt to afford a seat for the center 11, is formed while the lower end of the skirt is held in slightly flattened condition. In this manner the centering hole is given an oval shape and is arranged so that its short axis coincides with the axis A—A of the piston, which is parallel with the axis of the pin bosses.

The driving center 20 used in this application of the invention is similar to the center 11 of Fig. 1, but instead of being oval is round. When the center 20 is pressed into the oval centering hole, the general arrangement being similar to that of Fig. 1, the spring tension forcing the center 20 into the piston is sufficient to press the walls of the skirt on axis A—A outwardly until the entire inner periphery of the centering hole is in contact with the center 20. In this position, which is shown in Fig. 5, the outer periphery of the skirt is pressed outwardly on axis A—A from its original circular shape indicated in dotted lines at 21 in Fig. 5 to the full line position.

The piston is now ground with the usual grinding implements, and the grinding is continued until the outer surface of the skirt has been reduced to a true cylinder, which means that more material must be taken off at the parts lying on axis A—A than on the axis at right angles thereto.

After the finish grinding the piston is removed from the centers, and the inner periphery of the wall 19 then returns to its original shape, due to the resiliency of the skirt material. This means that the parts of the outer periphery lying on axis A—A fall below the true cylindrical shape indicated on dotted lines in Fig 6, thereby reducing the outside diameter of the skirt on axis A—A below the piston pin bosses to the full line position of Fig 6.

The eccentricities and changes of shape have been shown on an exaggerated scale in the drawings to make the subject matter clear.

It will be evident from this disclosure that the amount of ovalness in the resulting piston is greatest at the lower end of the piston and progressively becomes less toward the top of the skirt.

A person skilled in the art will perceive that this is a simple and efficient method for producing the effect sought for, and that it may be applied to any analogous article.

I claim:

1. The method of finishing a hollow cylindrical article which comprises expanding an end of the article into oval exterior shape, grinding the exterior surface of the expanded cylinder into truly cylindrical shape, and then releasing the expanded end to permit the exterior circumference thereof to assume an oval shape.

2. The method of finishing a hollow, cylindrical article having a closed end which comprises holding a true center on the closed end, expanding the open end into oval exterior shape, grinding the exterior surface of the expanded cylinder into truly cylindrical shape, and then releasing the expanded end to permit the exterior circumference thereof to assume an oval shape.

3. The method of finishing a piston having a closed head and pin bosses which comprises expanding the open end into oval exterior shape with the major axis parallel to the axis of the pin bosses, grinding the exterior surface of the expanded piston into truly cylindrical shape, and then releasing the expanded end to permit the exterior circumference thereof to assume an oval shape.

4. The method of finishing a piston having a closed head and pin bosses which comprises holding a true center on the closed head, expanding the open end into oval exterior shape with the major axis parallel to the axis of the pin bosses, grinding the exterior surface of the expanded piston into truly cylindrical shape, and then releasing the expanded end to permit the exterior circumference thereof to assume an oval shape.

In testimony whereof I affix my signature.

ADOLPH L. NELSON.