H. WESSON.

METHOD AND APPARATUS FOR FINISHING CURVED SURFACES.

APPLICATION FILED MAR. 10, 1921.

1,423,378. Patented July 18, 1922.

Fig. 1.

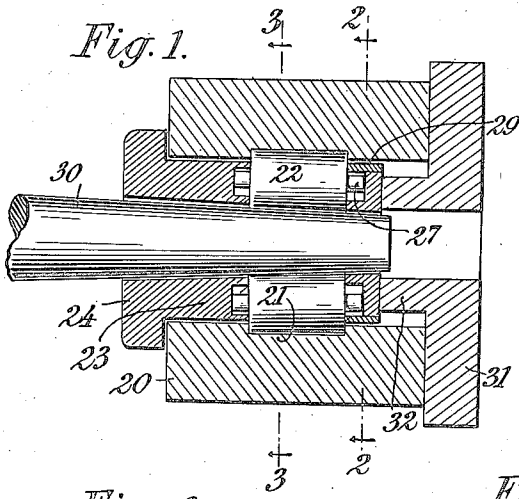


Fig. 2.

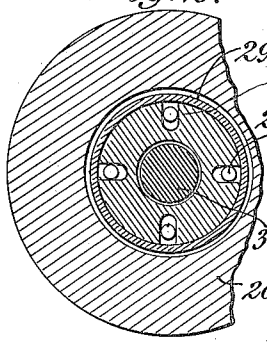


Fig. 3.

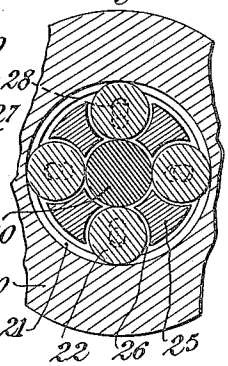


Fig. 6.

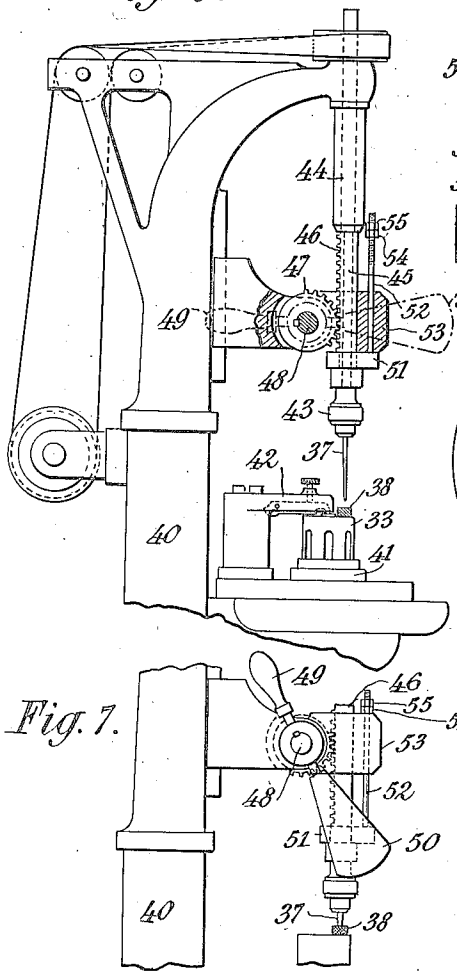


Fig. 4.

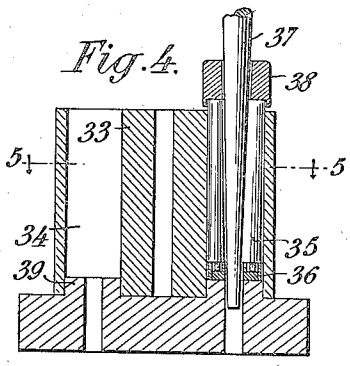


Fig. 9.

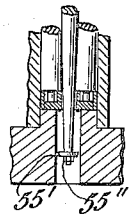


Fig. 5

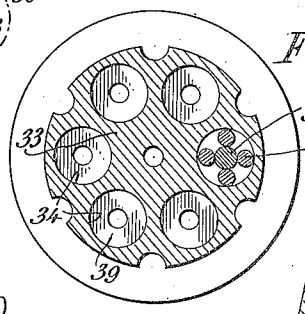


Fig. 8.

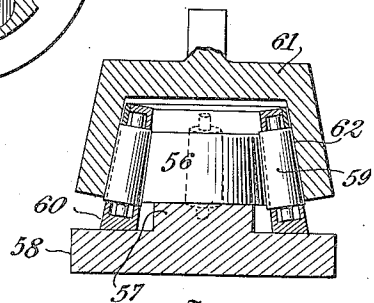


Fig. 7.

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METHOD AND APPARATUS FOR FINISHING CURVED SURFACES.

1,423,378. Specification of Letters Patent. Patented July 18, 1922.

Application filed March 10, 1921. Serial No. 451,208.

To all whom it may concern:

Be it known that I, HAROLD WESSON, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in a Method and Apparatus for Finishing Curved Surfaces, of which the following is a specification.

This invention relates to an improved method and apparatus for accurately finishing and polishing the surface of an object of suitable rigid material, such, for example, as steel, of sufficient malleable properties to be rolled.

The invention is particularly adapted for use as a means for very accurately sizing the cylindrical surfaces of cartridge chambers of revolver cylinders, rifles, machine guns and other fire arms. It is, however, adapted for other uses, as, for example, the finishing of race ways for roller bearings, and in fact any surface of circular cross section.

According to the present method of finishing a surface of the above-described character such, for example, as a cylindrical cartridge chamber, the cylinder is first drilled and reamed to an approximate size, after which it is finished by an expensive process of fine reaming and grinding.

By the use of the present invention, the finishing of the cylinder is effected by means of highly polished rollers preferably of hardened steel. These rollers are caused to roll upon the surface and are, at the same time, forcibly pressed against the same. Preferably, the rollers will be slightly tapered and may be forced with great pressure against the surface to be finished and at the same time rolled upon such surface by means of a master member having a correspondingly tapered surface. As the rolling is effected, the master member will be caused to gradually move in an axial direction, thereby causing the finishing rollers to be expanded in the cylinder until the surface has been brought to the exact dimensions required.

The amount of axial movement of the tapered master member may be accurately determined by a trip or stop which will cause the finishing operation to cease when the desired diameter has been obtained.

The above-described means of finishing a curved surface not only results in the production of a cylinder of extremely accurate dimensions, but, at the same time, imparts to the surface a highly polished or glass-like finish. This is of the greatest importance, especially in the making of cartridge chambers for fire arms, since it is well known that "hard extractions" are due to the expanding of the shell in a chamber which has not been accurately sized and polished to a sufficient degree of smoothness.

It will be apparent that the invention may be used as a means for sizing and polishing the outer surface of a roller or other similar object, by causing the hardened finishing rollers to roll about such outer surface, the rolling and pressing movement of the same being effected by a master member having a tapered inner surface.

It is recognized that a series of tapered rollers and a tapered master member, in some respects resembling the mechanism herein disclosed, have been used for the purpose of expanding tubes into the crown sheet or head of a boiler. Such devices, however, call for no extreme degree of accuracy as to the dimension of the rolled tube, and no means is provided for causing the advancement of the master member to cease or for otherwise causing the finishing process to be discontinued at the instant at which the rolled surface has been brought to an exact predetermined dimension.

In the drawings illustrating the mechanism used in practicing the invention,—

Fig. 1 is a section through a roller bearing, showing one form of the improved tool of the present invention adapted to finish an internal roller race way.

Fig. 2 is a cross section through the line 2—2 of Fig. 1, looking in the direction of the arrows.

Fig. 3 is a section through Fig. 1, along the line 3—3, looking in the direction of the arrows.

Fig. 4 is a longitudinal section through a revolver cylinder illustrating a tool for finishing a cartridge chamber, in accordance with the present invention.

Fig. 5 is a section on the line 5—5 of Fig. 4, looking in the direction of the arrows.

Fig. 6 is a side elevation of a drill press having parts modified in accordance with one embodiment of this invention.

Fig. 7 illustrates a portion of the same

drill press with certain parts moved to different positions.

Fig. 8 is a longitudinal section through a modified form of tool, adapted to finish the outer surface of a conical roller.

Fig. 9 illustrates a modification.

Referring more particularly to Figs. 1, 2 and 3, illustrating a form of the invention adapted to finish the internal race way of a roller bearing, 20 represents the bearing member having a cylindrical race way 21 to be finished to accurate dimensions and polished. The improved tool by which the finishing is effected, in accordance with the present invention, comprises a series of slightly tapered rollers 22 preferably of hardened, highly polished steel, mounted in a roller cage 23 having a head 24 by means of which it may be inserted into and withdrawn from the work piece.

The roller cage comprises a body portion 25 (Fig. 3) having recesses 26 to receive the rollers, and the rollers are provided at each end with a pin 27 movable radially in a slot 28 in the roller cage.

The end of the roller cage opposite the head 24 may be of reduced diameter and the slots 28, at the same end, may be open at their outer ends to facilitate the insertion of the rollers. The rollers may be prevented from accidental displacement from the roller cage by means of a ring 29 which may be forced over the end of the roller cage, thereby closing the open ends of the slots.

As a means for rotating the rollers 22 and at the same time forcibly pressing them against the surface 21, there is provided a master member 30, preferably of hardened steel, the same being slightly tapered to conform with the tapering of the rollers 22.

The invention in the form illustrated in Figs. 1, 2 and 3, may be used as follows:—

The bearing is placed upon a jig or work holder 31 having a stop 32 projecting into one end of the bearing. The rollers are then moved inwardly toward the axis of the roller case, this being permitted by the radial slots 28, and the roller cage and rollers inserted in the bearing, so as to bring the end of the roller cage against the stop 32. The tapered or conical master member is then inserted by means hereinafter to be described, and is rotated and gradually thrust endwise during its rotation so as to cause the rollers 22 to roll the surface of the race way and at the same time be forcibly pressed against the same, so as to slightly increase its diameter in accordance with the axial movement of the master member.

At the instant at which the surface 21 has attained a predetermined diameter, a further movement of the master member 30 is automatically prevented by means hereinafter to be described. By this means the race ways of a number of bearing members may be finished with extreme accuracy to uniform dimensions and the surfaces highly polished.

In Fig. 4 is illustrated a revolver cylinder 33 having cartridge chambers 34 to be accurately sized and polished by means of a tool of the above-described character having tapered finishing rollers 35 mounted in a roller cage 36 and a tapered master member 37. This tool may be similar to that illustrated in Figs. 1, 2 and 3, being merely varied in proportion to suit the relative dimensions of the work piece.

Although four rollers are illustrated, it will be apparent that three or five, or any suitable number may be used, depending upon the form of the work piece to be finished. If desired, the finishing tool may be provided with a knurled head 38 to facilitate its removal.

The jig or work holder for the revolver cylinder 33 may be provided with a plurality of stops 39, one for each cartridge chamber, which not only serve as means for receiving the end thrust of the roller cage but are also effective as a means for accurately positioning the cylinder to receive the master member.

One means for rotating and advancing the master member is illustrated in Figs. 6 and 7, which show an ordinary drill press 40 modified in accordance with one embodiment of this invention.

In the form illustrated, a work piece, as for example the revolver cylinder 33 of Fig. 4 is mounted in the usual indexing head 41 of the press and may be provided with any suitable clamping means 42 to hold the same in place. The tapered master member 37 is secured in a chuck 43 rotated by means of a spindle 44 which may be moved downwardly during rotation by means of a vertically movable quill 45.

The quill 45 is provided with a rack 46 in meshed engagement with the teeth of a pinion 47 which is keyed to a shaft 48 having fast thereon a rock arm terminating at one end in a handle 49 and at the other end in a heavy weight 50, which normally tends to rotate the shaft 48, and through the intermediary of the rack and pinion cause the chuck and the master member to be lowered.

Secured to a collar 51 carried by the quill 45 is an adjustable stop comprising a rod 52 extending upwardly through the quill guide 53 and provided with a stop or other suitable movement-limiting means herein disclosed as a nut 54 and lock nut 55 threaded upon the end of said rod.

By means of a drill press modified as above described, the accurate finishing of the surface in the work piece may be effected as follows:—

The work piece, as for example, the revolver cylinder, may be secured to its jig

in the indexing head of the press and properly positioned with the axis of the cylindrical surface to be finished in line with the axis of the chuck. The cylinder will then be clamped in place and the finishing tool inserted. The master member will be inserted in the chuck, and the chuck permitted to lower as far as permitted by the finishing rollers. The drill press will then be set in operation whereby the rotation of the master member will cause the finishing rollers to be rolled around the inner surface of the cartridge chamber, and at the same time the weight 50 will constantly tend to move the master member 37 downwardly so as to expand the rollers and gradually increase the diameter of the cylinder. This process will continue until the nut 54 engages the upper surface of the quill guide 53, at which point further downward movement of the master member will be prevented.

After finishing one chamber of the revolver cylinder, as above indicated, the clamp 42 may be loosened and the next chamber brought into proper relation with the axis of the chuck by a rotation of the indexing head, in the usual manner. The rollers and roller cage may then be removed from the finished cartridge chamber and inserted in the next chamber, after which the above-mentioned process may be repeated.

After finishing one end of the cartridge chambers, in this manner, the revolver cylinder may be inverted, if desired, and the other ends of the cartridge chambers finished in like manner.

By carefully adjusting the position of the stop 54, 55, the finished diameter of the cartridge chamber may be accurately determined, after which any number of cartridge chambers may be finished to exact and uniform diameters.

If desired, the tapered master member may be provided with a lifting disk 55′ which may be secured by a nut or any suitable fastening device 55″ at its end, whereby the tool may be automatically withdrawn from the cartridge chamber at the completion of the finishing operation, instead of removing the same by hand by means of the knurled head 38.

In Fig. 8 is illustrated a modified form of tool in accordance with the present invention, but adapted for finishing the outer surface of a conical roller or similar object. In this form of the invention, 56 illustrates a work piece supported on a stop 57 carried by a jig or work holder 58. The finishing rollers 59 are held in a roller cage 60 which may be supported by the upper surface of the jig. The master member in this form of the invention comprises a socket-shaped element 61 having an inner tapered surface 62 to engage the tapered finishing rollers 59.

The movement of the master member of the form of the invention illustrated in Fig. 8, as well as that illustrated in Fig. 1, may be effected and controlled by means similar to the modified drill press of Fig. 6, or by any equivalent means.

When it is desired to finish a portion of the inner surface at the end of a long cylinder, so that the use of the stop such as that illustrated at 32 (Fig. 1) as a means for limiting the endwise movement of the roller cage and rollers, becomes impracticable, the head 24 of the roller cage may be so positioned as to engage the cylinder end at which the master member enters as a means for limiting the endwise movement of such parts.

It will be understood that the invention is in no manner limited to the specific form herein disclosed for purposes of illustration, but that changes and modifications may be made within the scope of the appended claims.

What I claim is:

1. The method of imparting, to an article of suitable rigid material, a finished surface of revolution of a very high degree of smoothness and extreme accuracy of dimensions, which consists in first machining said surface, by any appropriate means, to a very close approximation of the desired finished form and then subjecting the same to a treatment by rollers of relatively small curvature having hard polished surfaces, said rollers being forcibly pressed against said surface while being rolled along the same, the rolling and pressing being continued until said surface has been highly polished and compressed with precision to a predetermined dimension, and being discontinued when said dimension has been attained.

2. The method of making a cylindrical hole, having a surface of glass-like smoothness and extreme accuracy of dimensions, in an article of suitable rigid material, which consists in first drilling a hole in said article and reaming the same to a close approximation of the desired finished size, and then subjecting the same to a treatment by rollers having hard polished surfaces, said rollers being forced outwardly so as to be pressed against said surface while being rolled along the same, the rolling and pressing being continued until said surface has been highly polished and the hole increased with precision to a predetermined diameter, and being immediately discontinued when said diameter has been attained.

3. Apparatus for imparting, to an article of suitable rigid material, a surface of revolution of a very high degree of smoothness and extreme accuracy of dimensions, comprising a series of finishing rollers having hard smooth surfaces of circular cross section but of gradually increasing diameter,

and a master member also having a hard surface of circular cross section but of gradually increasing diameter, said finishing rollers and master member having their surfaces in rolling contact, means for rotating said master member and at the same time imparting thereto an axial movement whereby said finishing rollers are pressed laterally against the surface to be finished, and means comprising a stop for automatically arresting said axial movement of said master member after movement of a predetermined extent.

4. Apparatus for compressing and polishing the material surrounding a hole in an article of suitable rigid material, to give the same a cylindrical surface of glass-like smoothness and extremely exact and uniform dimensions, comprising a series of finishing rollers having hard smooth conical surfaces all converging in one direction, a master roller having a hard conical surface converging in the opposite direction, said finishing rollers being so disposed as to roll within the cylindrical surface to be treated when in rolling contact with said master roller, means for rotating said master roller and at the same time imparting thereto an axial movement whereby said finishing rollers are pressed outwardly against the surface to be finished, and means, comprising a stop, for automatically arresting said axial movement of said master roller after movement of a predetermined extent.

5. The method of making a cylindrical hole, having a surface of glass-like smoothness and extreme accuracy of dimensions, in an article of suitable malleable metal which consists in first drilling a hole in said article, and reaming the same to a close approximation of the desired finished size, and then subjecting the same to a treatment by rollers having hard polished surfaces, said rollers being forced outwardly so as to be pressed against said surface while being rolled along the same, the rolling and pressing being continued until said surface has been highly polished and the hole increased with precision to a predetermined diameter, and being immediately discontinued when said diameter has been attained.

6. Apparatus for compressing and polishing the metal surrounding a hole in an article of suitable malleable metal, to give the same a cylindrical surface of glass-like smoothness and extremely exact and uniform dimensions, comprising a series of finishing rollers having hard, smooth conical surfaces all converging in one direction, a master roller having a hard conical surface converging in the opposite direction, said finishing rollers being so disposed as to roll within the cylindrical surface to be treated when in rolling contact with said master roller, means for rotating said master roller and at the same time imparting thereto an axial movement whereby said finishing rollers are pressed outwardly against the surface to be finished, and means, comprising a stop, for automatically arresting said axial movement of said master roller after movement of a predetermined extent.

In witness whereof, I have hereunto signed my name.

HAROLD WESSON.