A. F. DONALDSON.

METHOD OF BROACHING ARTICLES.

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1,318,488. Patented Oct. 14, 1919.

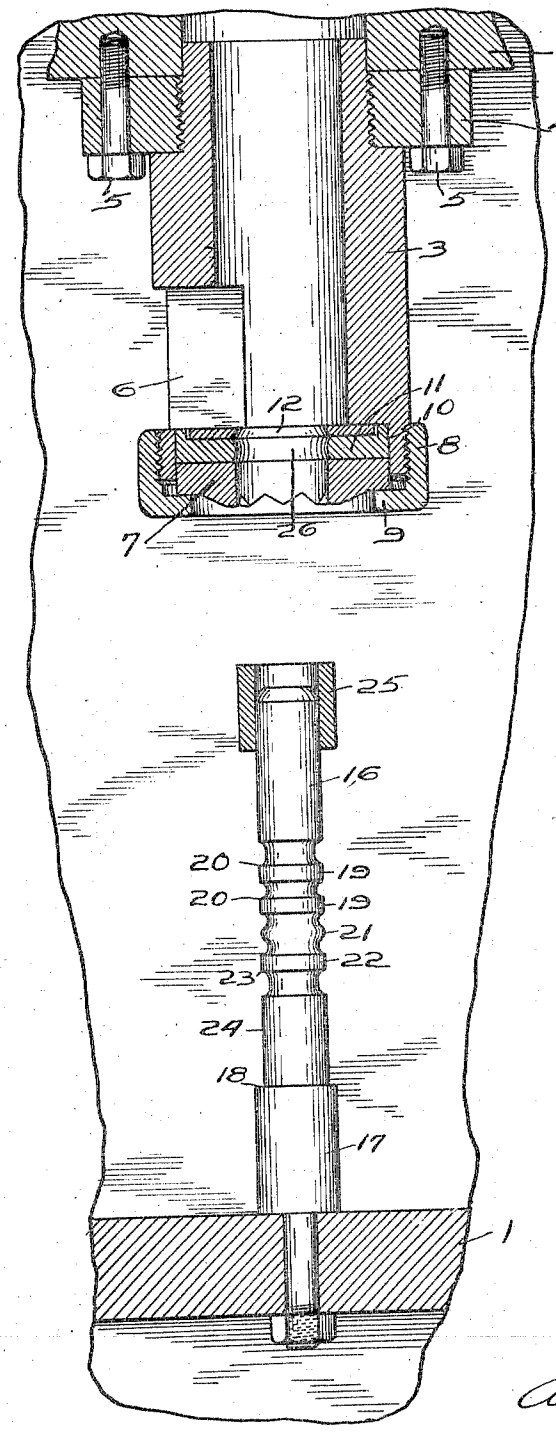



Fig. 1.

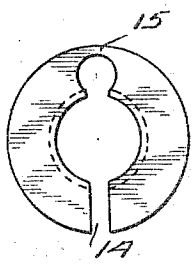



Fig. 2.

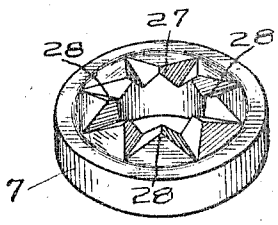



Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## METHOD OF BROACHING ARTICLES.

1,318,488. Specification of Letters Patent. Patented Oct. 14, 1919.

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*To all whom it may concern:*

Be it known that I, AUGUSTUS F. DONALDSON, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Method of Broaching Articles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to broaches and has for its object to provide a means for broaching an object exteriorly. It also has for its object to provide a means that will broach an object interiorly as well as exteriorly so as to produce a smooth interior surface.

It also has for its object to provide a method of broaching objects exteriorly and interiorly.

My invention may be modified by those skilled in the art without departing from the spirit thereof. I shall describe hereinafter a construction containing my invention and one whereby the process may be carried out in the use of the construction. The construction selected is illustrated in the accompanying drawings.

Figure 1 of the drawings is a side view of a part of a broaching machine, one of the broaches being shown in section. Fig. 2 is a top view of a stripper plate for removing bushings from one of the broaches. Fig. 3 is a perspective view of an exterior broach.

1, Fig. 1, is a bolster plate or bed of the broaching machine. 2 is a reciprocating plunger which is moved to and away from the bolster plate 1 by any suitable mechanism. 3 is a holding member or sleeve for holding the exterior broach. It may be secured to the plunger 2 by a suitable member such as the collar 4 and the bolts 5. It may also be provided with an opening 6 through which the bushings may be ejected by any suitable means after the same have been broached. The exterior broach 7 may be secured to the end of the sleeve in any suitable way such as by the flanged collar 8 which is threaded over the end of the sleeve 3 while the inwardly turned flange 9 clamps over the edge of the broach 7. The broach 7 may be located in a socket 10 formed in the end of the sleeve 3 to prevent any lateral play of the broach 7 within the sleeve. If desired, a compacting bead or ring 11 may also be inserted in the socket 10 and so as to operate upon the article that is broached by the broach 7 to knead and compact the surface and give the article exterior polish.

The article to be broached exteriorly may be placed upon a suitable stem or support so as to place the bushing substantially coaxial with the broach 7 and so that upon movement of the broach relative to the bushing, the broach will cut the exterior surface of the bushing. If a bushing is to be broached it may be placed on a mandrel tightly fitting the bushing in order that the wall of the bushing will be sustained while it is being operated upon by the outside broach. The mandrel may be made slightly over-size as compared to the interior diameter of the bushing in order to allow for the elasticity of the metal of the bushing. To facilitate the cutting operation and to break up the chips that are cut away, the cutting edge of the broach 7 may be provided with cutting teeth 27 to prevent continuity in the ring formation of the metal that is shaved or cut away from the article that is broached. The teeth may be formed by forming corrugated or saw shaped serrations. The serrations also provide a means for extending the length of the cutting edge which reduces the force required to move the article through the broach or to move the broach over the article. In the broach shown, the serrations are saw tooth shaped and the points of the teeth terminate ridges 28 that extend radially from the center of the broach which give strength to the teeth that they would not have if the points formed the intersection of inclined radially extending planes and the exterior cone surface shown in Fig. 3 of the drawing.

The interior diameter of the broach varies according to the size of the bushing that is broached, but in broaching rough castings it is made sufficiently less than the diameter of the bushing or the article to be broached to insure the maintenance of the edge beneath the scale or crust-like surface formed on the article in the casting thereof. For broaching a bronze article, the broach should have a diameter of .035 of an inch less than the article in the rough in order that the broach may maintain its position beneath

the scale or crust-like surface during the broaching operation. This is true of articles about 1 inch in diameter. If however, the article to be produced is to have a greater diameter, the difference between the article in the rough casting and the inner diameter of the broach should be greater on account of the variability of the diameter of the article at different points along the article while in the rough.

A stripper plate 12 may be located in the socket 10 or it may be located in a recess formed in the inclosed beaded ring 11. The stripper plate is provided with an opening to receive the articles broached. It forms two spring pressed semi-rings, the diameter of the opening being less than the diameter of the articles broached. It is formed by cutting the plate through at one side such as at 14 and reducing its cross section on the opposite side such as at 15. The edge of the opening of the stripper plate moreover is beveled so as to permit the stripper plate to pass over the bushing and cause the stripper plate to spread and when the article has passed through the stripper plate, it will slip beneath the article and engages it so as to hold it within the sleeve 3. The article may then be pushed by any suitable means through the opening 6.

When a bushing is to be broached both exteriorly and interiorly, it may be placed on the end of the interior broach such as upon the pilot 16 of the broach 17. The broach 17 may be bolted or secured to the bolster plate or to the bed 1 of the machine in any suitable way. When the plunger 2 descends, the broach 7 will engage the bushing near its outer edge and push the bushing over the broach 17 until the bushing is brought to a stop by means of a shoulder 18 formed on the broach 17 whereupon the broach 7 will operate to broach the bushing exteriorly and until the bushing passes through the stripper plate 12 into the sleeve 3.

The broach 17 may be used with any suitable female broach when it is desired to broach the interior and the exterior of the bushings in one operation of the ram of the punch press. It has, however, been found in practice that the compressing action of the male broach will, under such conditions, produce irregular surfaces on the interior of the bushing. The best results are obtained when the broaches operate in succession on the bushing. This will prevent operation of either of the broaches when the other broach is cutting or compacting the surface and thus the bushing will be operated upon when it is uniformly compressed or stretched, that is, when its wall is sustained against the action of one or the other of the broaches.

In the form of interior broach shown in the drawing, the broach is provided with cutting ridges 19 having cutting edges 20 that increase in diameter successively from the pilot 16. A bead 21 is located below the cutting ridges 19 which operates to knead the interior surface of the bushing. The bead 21 is of a diameter larger than the preceding cutting ridge 19. This is followed with the ridge 22 which has a diameter that is slightly less than the diameter of the bead 21 so as to permit the bead to compress the surface of the bushing. The ridge 22 has a cutting edge 23 on the following side of the ridge 22 that is away from the pilot 16. The broach 17 is also provided with a shank 24 that receives the bushing after the same has been operated upon by the cutting edges 20 and the bead 21. The diameter of the shank 24 is slightly less than the diameter of the cutting ridge 22 so that when the bushing has been stopped by the shoulder 18 located in the lower end of the shank 24 and the broach 7 has performed its operation on the exterior surface of the bushing and the bushing is caught by the stripper plate 12 on the return movement of the plunger 2, the bushing is cut by the edge 23 of the ridge 22 and is again operated upon by the bead 21 and to a very slight extent by the surface of the lowermost ridge 19 since the diameter of the finished bushing is substantially the same as the diameter of the lowermost cutting ridge 19. To form a bushing having substantially 1 inch interior diameter when finished, the uppermost ridge 19 may be made about .002 of an inch undersize. The bead 21 may be made .004 of an inch oversize the cutting ridge 22 may be made .003 of an inch oversize and the shank 24 may be .002 of an inch oversize. These dimensions of course will be varied according to the composition of the metal, the thickness of the wall of the bushing and according to the diameter of the bushing to be formed. The number of cutting ridges and beads may also be varied according to the conditions existing in the bushing that is formed by the broaches.

Unless the wall of the bushing is exceedingly thick, it has been found that the compressing produced by the cutting action of the broach 7 while the bushing is on the shank 24, that notwithstanding the fact that the shank 24 is oversize yet a watered silk appearance of the bushing is sometimes produced on the interior of the bushing but without causing any mechanical defects in the bushing if removed from the shank without being passed again over the cutting ridges and beads. This appearance however is removed by the return of the bushing as it passes over the cutting edge 23 of the ridge 22 which is about .001 of an inch larger than the shank 24. The bushing is again acted upon by the bead 21 to form a

compacted layer beneath the surface and in this way operates the same as two beads on a broach that is pushed straight through the bushing without the return of the broach.

I claim:

1. The process of producing bearings which consists in broaching the interior of the bushing then broaching the exterior of the bushing and then again broaching the interior of the bushing.

2. The method of broaching bushings which consists in broaching the interior of the bushing, then broaching the exterior of the bushing while the bushing is retained in a stretched position, then again broaching the interior of the bushing.

3. The method of producing finished bushings which consists in broach cutting the exterior surface of the bushing while the bushing wall is maintained in a stretched condition.

In testimony whereof, I have hereunto signed my name to this specification.

AUGUSTUS F. DONALDSON.