Oct. 16, 1934. R. L. WILCOX 1,977,162

METHOD OF MAKING ARTICLES HAVING A POLYGONAL CROSS SECTION

Filed May 15, 1933 2 Sheets-Sheet 1

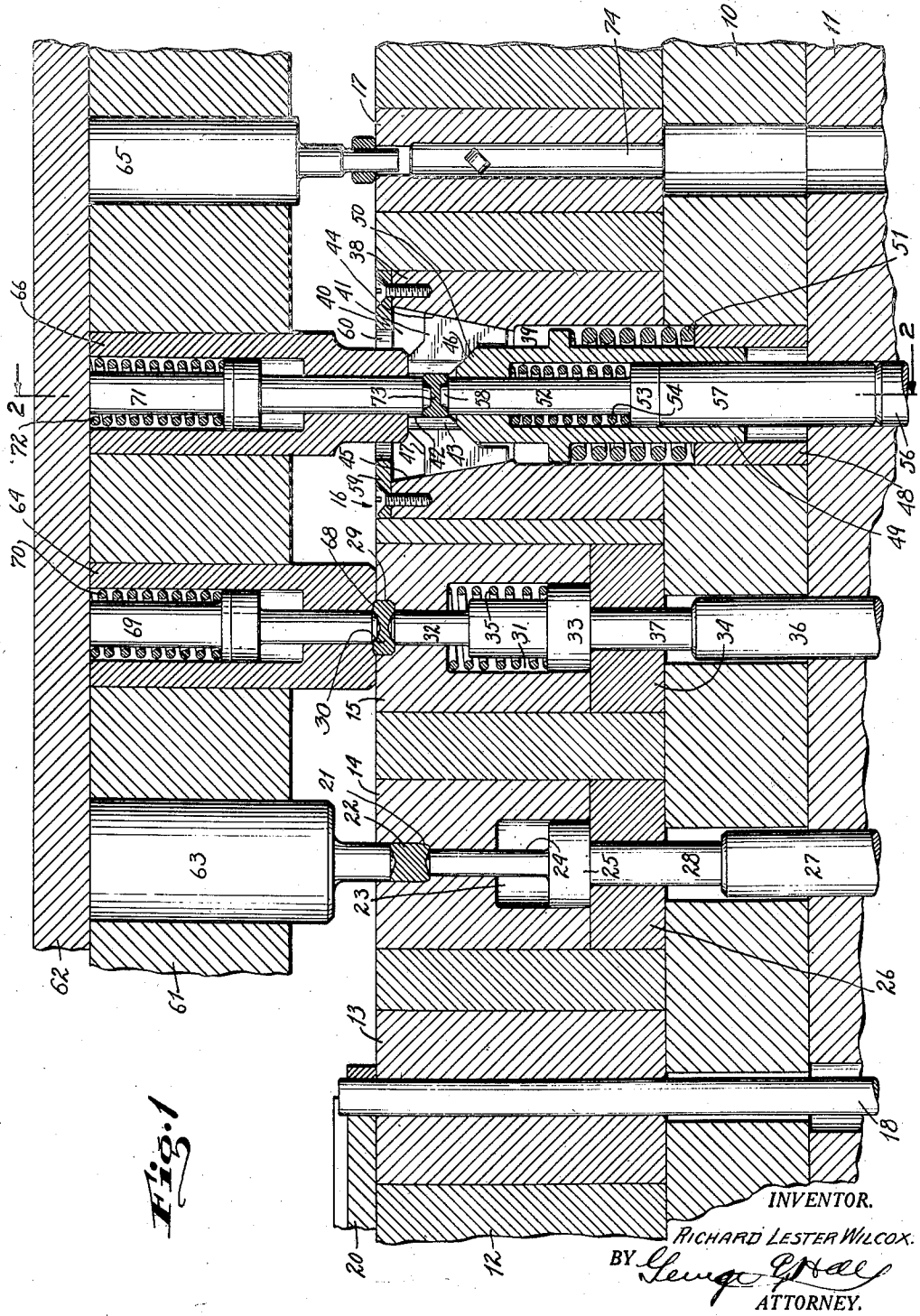

Fig. 1

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Fig. 2

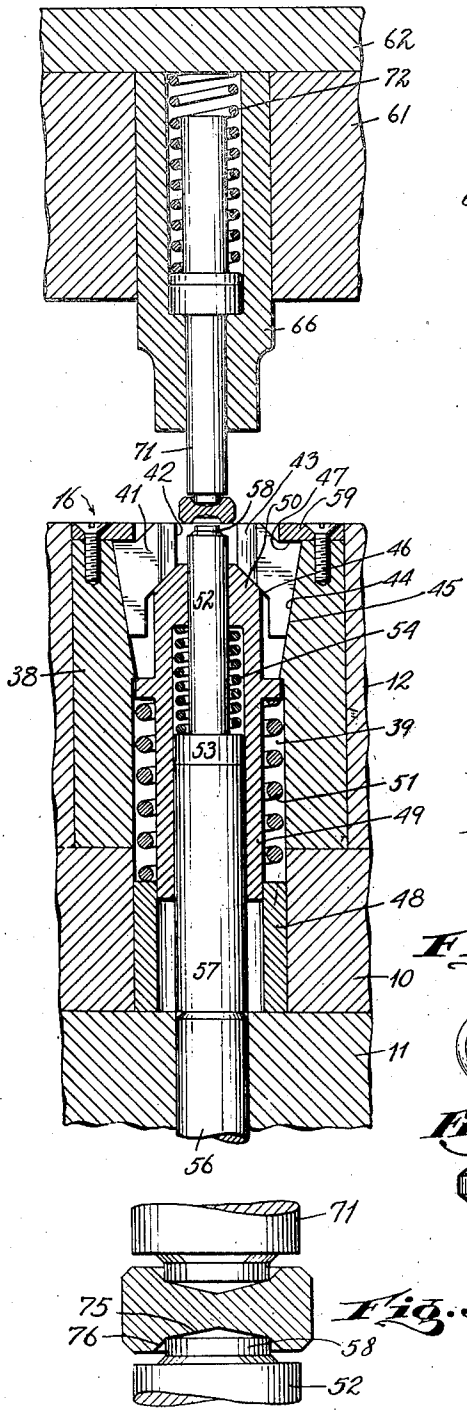

Fig. 3

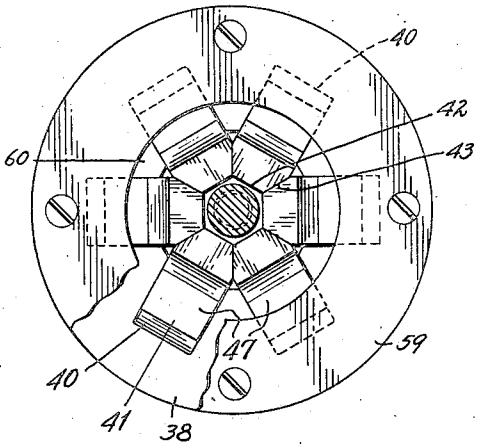

Fig. 4

Fig. 4a

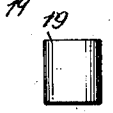

Fig. 5

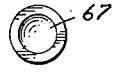

Fig. 5a

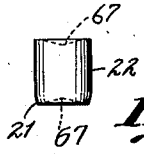

Fig. 6

Fig. 6a

Fig. 7

Fig. 7a

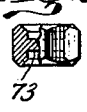

Fig. 8

Fig. 8a

Fig. 9

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1,977,162

METHOD OF MAKING ARTICLES HAVING A POLYGONAL CROSS SECTION

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Application May 15, 1933, Serial No. 671,166

5 Claims. (Cl. 10—86)

This invention relates to improvements in means and method for making articles having a polygonal cross section, and is disclosed herein as applied to the formation of an article such as a nut blank or the like.

The general object of the invention, among others not enumerated, is that of producing articles of the character described from a blank that is initially longer than the height of the finished article, and of less cross sectional area, by means that provide for the minimum wastage of metal, and a flow of the metal during the several operations that will require the minimum pressure; and further, to provide a chamfer on either or both sides of the nut, as may be desired, this latter being produced by the flow of the metal as distinguished from a pressure operation, and the article when completed will be of superior toughness, both in the body of the nut and the walls of the opening therethrough.

The merits of the present invention will appear by the following disclosure of one embodiment thereof, which is given merely by way of example and the utility of the invention will be obvious from the advantages which are realized in the particular embodiment illustrated.

In the accompanying drawings, wherein like numerals of reference indicate like parts in the several figures;

Figure 1 is a sectional view of the applicable portion of mechanism utilized in this invention;

Figure 2 is a transverse sectional view of a portion thereof, the parts in section being taken generally upon line 2—2 of Figure 1, the relative position of the parts, however, in this view being different than in Figure 1;

Figure 3 is a fragmentary plan view of the forming die;

Figure 4 is one view of the blank as cut from a rod or otherwise produced; Figure 4ª is another view of the same blank.

Figure 5 is one view of the blank after the first pressure operation, the ends thereof now having depressions; Figure 5ª is another view of the same blank.

Figure 6 is one view of the blank after a succeeding pressure operation, the height of the blank being now reduced and its diameter increased; Figure 6ª is another view of the same blank.

Figure 7 is one view of the blank after a succeeding pressure operation, and in its completed exterior shape; Figure 7ª is another view of the same blank.

Figure 8 is one view of the completed article; Figure 8ª is another view of the same blank, and

Figure 9 is a sectional view on an enlarged scale of the blank as presented to the tools shown in Figure 2.

By the means and method herein disclosed a blank, whether cut from a wire rod, or otherwise produced, is by pressure countersunk at the opposite ends, and thereafter subjected to endwise pressure upon its ends. This pressure reduces its height and increases its diameter, so that it is slightly larger than the distance across the corners of the completed article. Thereafter, by lateral pressure, the blank is shaped into its substantially completed exterior form, the depressions therein being substantially the same size as the opening or hole through the blank, and formed during the last pressure, with a comparatively thin web between the bottoms thereof. Thereafter, this web is removed and the nut is in its completed form ready for the threading operation.

The improved mechanism herein disclosed may be associated with a power press, header or the like, although not necessarily limited thereto.

The numeral 10 designates the die bed that is secured to the body 11 of the machine, and upon which is fixed a die block 12 in any preferred manner. Within this latter is a cut-off die 13, pressure dies 14 and 15, forming die 16, and piercing die 17. The opening in the cut-off die 13 is substantially the same shape and size in cross section as the rod 18, from which the blanks 19 are cut by the knife 20.

In the face of the pressure die 14 is a recess of substantially the same shape and dimensions as the blank 19, and if desired, the bottom corners may be flat or rounded slightly to form angular or rounded corners 21 on the blank 22. In a recess 23 in the pressure die 14 is movably mounted a combined punch and ejector 24 having a head 25 that bottoms in one of its positions against the anvil block 26. Between the head 25 and the knockout rod 27 is an ejector pin 28.

The pressure die 15 has a recess 29 in its face, which is substantially the same diameter as the blank 30, the bottom corners thereof being preferably angular to form a chamfer on one face of the blank. Within this die 15 is a recess 31 enclosing a punch 32 having a head 33 which rests against the anvil block 34 and a coil spring 35 between the head 33 and an end wall of the recess. Between the head 33 and the knockout rod 36 is an ejector pin 37. When the heads 25 and 33 of the members 24 and 32 are against the anvil blocks 26 and 34, the outer ends there-

of form a bottom for the recesses in the dies 14 and 15, respectively. The end of each of these punches is pointed and forms a depression in one face of the blank, the punch 24 being pointed with a slightly more acute angle 75 than that formed (76) by the punch 32. The forming die 16 comprises a body member 38 through which is an opening 39, and in the walls of the smaller diameter thereof are six radial slots 40 at an angle to the axis of the opening 39, as this die is designed to produce an article hexagonal in cross section. A greater or less number of faces on the article will correspondingly increase or reduce the number of radial slots.

Movable in each slot is a pressure die 41, having a straight inner face 42 and angular adjacent faces 43, which contact with each other when the pressure dies are in their innermost positions. Each pressure die has an outer cam face 44 which rides against the angular wall of the slots 40, an inner cam face 46, and a stop shoulder 47.

Movably mounted within the opening 39 and a bushing 48 is a sleeve 49, having a cone head 50, the angle of inclination of which is substantially the same as that of the cam faces 46 which engage therewith. Surrounding the sleeve 49 between a collar thereon and the bushing 48 is a coil spring 51. Within the sleeve 49 is the punch 52, having a head 53 thereon, which is movable in a recess in the sleeve. Between the head and an end wall of the recess is a coil spring 54, which requires less pressure to compress than the spring 51. Between the head 53 and the knockout rod 56 is an ejector rod 57.

The tip 58 of the punch 52 corresponds in size with the opening or hole in the finished article and is longer than the depth of the depression formed by prior operations.

Secured to the body member 38 by screws or other similar means is the stop plate 59, having an opening 60 therethrough, which is engaged by the stop shoulders 47 on the dies 41 to limit their movement in one direction.

A plunger or gate 61 is operated in any well known manner toward and away from the die block 12. Associated and movable with the plunger or gate 61 is a backing plate 62, and against which contact the several punches 63, 64 and 65, and the punch carrier 66. The end of the punch 63 is substantially the same diameter as that of the blank 19 and is provided with a tapered tip of substantially the same size and shape as the tip upon the member 24. After the blank is cut from the rod 18 and transferred in any convenient or well known manner in line with the recess in the die 14, it is projected therein by the punch 63. Both ends of the blank are thus squared so as to be substantially parallel with each other and at a right angle to the axis of the blank, and depressions 67 are formed in such ends. This operation insures a blank without a bur, fin or the like, that is square at both ends, and provided with initial depressions therein. The face of the punch 64 is provided with a recess 68, having angular corners at the bottom thereof to form a chamfer upon one face of the blank 30.

Within the punch 64 is a punch 69 that is of substantially the same diameter as the punch 32, and a tip corresponding therewith. When the inner end of the punch 69 contacts with the plate 62, its outer end is in upsetting pressure position.

The knockout rod 36 insures the ejection of the blank from the recess in the pressure die 15, and likewise from the recess in the punch 64 through the punch 69 and coil spring 70. The blank 22 is presented in line with the pressure die 15 and punch 64 and centered relative thereto by the tips of the punches 32 and 69, which hold the blank against relative movement while the transfer mechanism is being disengaged therefrom. Between these punches the height of the blank is reduced, the metal flowing outwardly and filling the recesses in the die 15 and punch 64, and the tips of the punches 32 and 69 forming a depression in two faces of the blank, substantially as shown. Each of these tips has a flat end and angular walls which increase the circular area of the depressions in the article without losing the tapered center at the bottom of the depression as formed in a prior pressure operation. The angular corners formed on the blank in their last operation insures the formation of chamfered corners upon opposite faces of the finished article. Obviously, the blank may be formed with a chamfer on only one face if desired.

Within the punch carrier 66 is a punch 71, actuated in one direction by a coil spring 72, and of substantially the same diameter as the punch 52 and a tip of substantially the same shape. When the punch 71 contacts at its inner end with the backing plate 62, its outer end is in its pressure position.

The blank 30 is transferred into line with the punches 52 and 71 and the tips of each project into the depressions in opposite faces of the blank and center and hold it while the transfer mechanism is disengaged therefrom. The blank is supported between these two punches while the plunger or gate 61 is moving toward the bed 10 and carried into position between the pressure dies 41, the punch 52 receding during this operation. The relative position of the parts of the forming die 16 as the blank is about to be presented thereto and still held by the transfer mechanism, is shown in Figure 2. As the plunger or gate 61 continues its movement toward the bed 10, the end of the punch carrier 66 applies endwise pressure to the dies 41, which move inwardly toward each other within the body member 38 and the sleeve 49 moves endwise away from the blank. During this action of the punch carrier 66, the punch recedes against the tension of the spring 72, and the face of each pressure die 41 is forced against the perimeter of the blank, changing its form from a cylindrical blank to one having a polygonal cross section, and increasing its height. The sleeve 49 during this operation travels away from the blank, now held between the dies, faster than the metal flows, thus leaving an open space between it and the blank.

Moving the sleeve 49 away from the blank permits an unrestrained metal flow on the underside thereof, substantially parallel with the axis of the blank. As the spring 72 is relatively light there is practically no resistance to the flow of the metal upwardly as the punch carrier 66 advances. When the plunger or gate 61 travels away from the bed 10 the spring 51 pushes the sleeve 49 outwardly and engagement of the coned head 50 with the dies 41 gives them a lateral outward movement away from the blank, until the stop shoulders 47 engage the stop plate 59. During this action the punch 52 is projected outwardly by the knockout rod 56, with the result that the blank is in the position substantially as shown in Fig-

ure 2 and the punch ready for engagement by the transfer mechanism. After the blank is engaged by the transfer mechanism the punches 52 and 71 are disengaged therefrom and it is ready for presentation to the piercing die 17, which operates in a well known manner.

The blank, after the forming die operation, is in the form substantially as shown in Figure 7, wherein 73 indicates the thin web between the bottom of the depressions.

The tips of the punches 52 and 71 are of less diameter and greater depth than the depressions in the blank as presented thereto. Therefore, the metal under the pressure of the dies 41 flows around these tips and the former countersunk depressions now have a substantially uniform diameter and the same as the opening or hole in the finished article, of which these are now a part. Thus the walls of said hole to be subsequently threaded are toughened and more homogeneous.

The piercing punch 65 is substantially the same size as the tips on the punches 52 and 71, and the article is completed by removing the web portion 73, which when severed drops through an opening 74 in the piercing die 17 into a receptacle conveniently arranged to receive it. The article (nut), as herein described, is now complete and ready for the threading operation without further trimming operations thereon.

By the means and method herein shown, a homogenous and toughened nut is produced from a wire rod or length by means entirely automatic and with the minimum wastage of material. Such nut is of superior quality and adapted for use in places where resistance to pressure and strain is especially desirable.

The above disclosure is given merely as one embodiment of the present invention, which is not to be considered as limiting the invention, the scope thereof being determined by an understanding of the present disclosure as one embodiment thereof and as particularly pointed out in the appended claims.

What I claim as new is:

1. The method of forming an article, having a polygonal cross section and an opening therethrough, which resides in forming a substantially cylindrical disk of less height than the finished article with depressions in opposite faces thereof of greater area than the said opening, and thereafter subjecting the disk to pressure around the perimeter thereof in a direction at substantially a right angle to its axis while a rigid member is in each of the depressions, whereby the disk is made polygonal, the thickness thereof increased, and the metal caused to flow around the said members to form recesses in opposite faces of the article with a web therebetween and thereafter removing said web, said perimeter pressure being derived initially from a pressure that is applied substantially opposite to and substantially parallel with an end face of the article.

2. The method of forming an article, having a polygonal cross section and an opening therethrough, which resides in first subjecting a substantially cylindrical blank longer than the thickness of the article to endwise pressure to reduce the length of the blank to less than the thickness of the article and increase its diameter so that it is greater than the distance across the corners of the polygon and form depressions in the opposite faces thereof, and thereafter subjecting the blank to pressure around the perimeter thereof in a direction at substantially a right angle to its axis while a rigid member is in each of the depressions, whereby the blank is made polygonal, the thickness thereof increased, the metal caused to flow around said members to form recesses in opposite faces of the article with a web therebetween and thereafter removing said web said perimeter pressure being derived initially from a pressure that is applied substantially opposite to and substantially parallel with an end face of the article.

3. The method of forming an article, having a polygonal cross section, which resides in subjecting a substantially cylindrical blank of larger cross sectional area and less height than the finished article, to a constant pressure upon plural portions of the perimeter thereof, corresponding in number with the sides of the polygon, in a direction at substantially a right angle to its axis and in as many directions as there are sides to the polygon until the blank has assumed a polygonal shape, said pressure being derived initially from a pressure that is applied substantially opposite to and substantially parallel with an end face of the article.

4. The method of forming an article, having a polygonal cross section and an opening therethrough, which resides in forming a blank of larger cross sectional area than the finished article with depressions therein which are of greater area than the said opening and thereafter, with rigid members in the depressions, applying pressure around the perimeter thereof in a direction at substantially a right angle to its axis, and in as many directions as there are sides to the polygon and whereby the blank is given a polygonal form and the metal of the blank caused to flow around the rigid members and thereafter piercing a hole through the blank, the perimeter pressure being derived initially from a pressure that is applied substantially opposite to and substantially parallel with an end face of the article.

5. The method of forming an article having a polygonal cross section which resides in subjecting a substantially cylindrical blank of larger cross sectional area than the finished article with depressions in opposite faces thereof, the bottom of which having plural angles of inclination, with a rigid member in each depression, to a constant pressure upon plural portions of the perimeter thereof, corresponding in number with the sides of the polygon, in a direction at substantially a right angle to its axis and in as many directions as there are sides to the polygon, whereby the blank is given a polygonal form and the metal of the blank caused to flow around the rigid members, and thereafter piercing a hole through the blank.

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