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METHOD OF MAKING CASTLE NUTS

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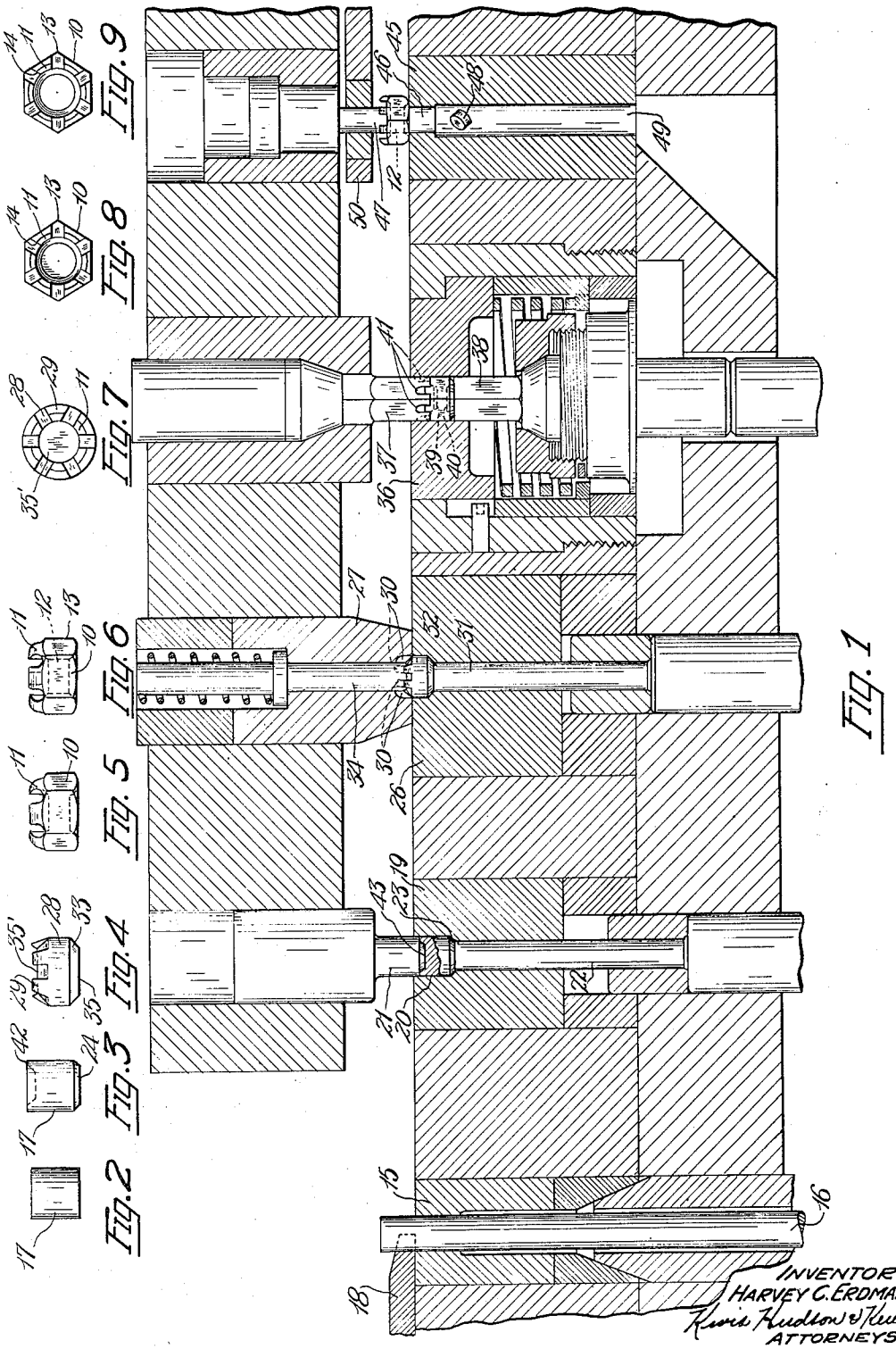


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

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## METHOD OF MAKING CASTLE NUTS

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9 Claims. (Cl. 10—86)

This invention relates to the production of nuts of the type known as castle nuts and, as one of its objects, aims to provide a new and improved method for economically producing a superior quality of these nuts.

Another object of my invention is to provide a novel method for economically producing castle nuts which comprises upsetting a section of stock and at the same time forming a plurality of castle prongs thereon, and thereafter displacing some of the metal of the blank to form a nut face adjacent each prong and a corner between each pair of adjacent prongs.

More specifically, my invention aims to provide an improved method for the production of castle nuts which comprises upsetting a section of stock into a substantially dome-shaped solid having opposed flattened areas thereon and at the same time forming a plurality of castle prongs around one of said areas, and thereafter applying pressure to the blank in a die cavity of polygonal shape and squeezing metal outwardly to form a corner on the blank between each pair of adjacent prongs.

A further object of the invention is to provide an improved method for the producing of castle nuts by applying pressure to a section sheared from bar stock to square the ends of the section with respect to its axis and to form a depression in one of said ends with metal upstanding around the depression, and thereafter upsetting the section and shaping the upstanding metal into castle prongs.

It is also an object of my invention to provide an improved form of castle nut of polygonal shape wherein the nut corners are located intermediate the pairs of adjacent castle prongs.

The invention may be further briefly summarized as consisting in an improved form of castle nut and in certain operations and novel steps of procedure, as hereinafter described and particularly set out in the appended claims.

In the accompanying sheet of drawings.

Fig. 1 is a sectional view taken through an arrangement of apparatus which may be used in carrying out my novel method;

Fig. 2 is a side elevational view of the blank from which a castle nut is to be formed;

Fig. 3 is a side elevation of the blank after the straightening and squaring operation has been performed thereon;

Fig. 4 is a side elevation of the blank after the first forming operation;

Fig. 5 is a side elevation of the blank after the second forming operation;

Fig. 6 is a side elevation showing the castle nut after the tap opening has been formed therein;

Fig. 7 is a plan view of the blank shown in Fig. 4;

Fig. 8 is a plan view of the blank shown in Fig. 5; and

Fig. 9 is a plan view of the castle nut as shown in Fig. 6.

For a more detailed description of my improved castle nut and of my improved method of making castle nuts, reference will now be made to the accompanying drawing wherein I have illustrated the steps of my method and have shown one form of apparatus which may be used in carrying out the same. It will be understood, of course, that various other forms of apparatus may be employed in practicing my method.

My improved castle nut, as shown in Figs. 6 and 9 of the drawing, is of suitable polygonal shape, in this instance hexagonal, although it may assume various other forms. This improved castle nut is formed with hexagonally disposed side faces 10 and with a plurality of upstanding lugs or castle prongs 11 at one end of the nut around the tap opening 12 therein. According to my invention, as will be explained more fully hereinafter, the corners 13 are formed on the nut between the pairs of adjacent prongs, or in other words, the prongs themselves are centered on the nut faces and the slots between the pairs of adjacent prongs lie above the nut corners. With this construction I find that the prongs are very strong and rugged and that they present large bearing faces 14 for engagement with the usual cotter pin.

Before entering into a detailed description of the apparatus illustrated in the drawing, I shall briefly outline the several steps or operations of the method. The first operation consists in shearing a blank from a bar of stock to provide approximately the correct amount of metal for forming a castle nut. In the second operation, the blank, which is usually distorted by the

shearing operation, is straightened and its end faces squared with respect to the axis of the blank. The third operation is a forming operation during which the blank is upset, to approximately the height of the desired castle nut, by endwise pressure applied to the blank in a die cavity and, at the same time, castle prongs are formed on one end of the blank. The fourth operation is also a forming operation wherein pressure is applied to the blank in a die cavity to displace metal from the center of the blank into the sides thereof and to form the blank to the desired polygonal shape. The succeeding operation is a shearing operation wherein excess metal is sheared from the center of the blank to provide a tap opening therein.

In Fig. 1 of the drawing, I have shown apparatus which may be used in carrying out the various steps of my improved method, although other forms of apparatus may also be employed for this purpose. This apparatus embodies a die 15 through which a bar of metal stock 16, of suitable shape, preferably of round cross-section, may be moved as by a step-by-step motion, so that an extended portion of the bar may be sheared therefrom to provide a blank 17 containing approximately the correct amount of metal for a desired castle nut. The blank may be sheared from the bar of stock by any suitable means, such as the laterally movable shearing tool 18 which cooperates with the die 15.

During the shearing operation which cuts the blank 17 from the bar of stock, the blank may be distorted to some extent and it is usually desirable to straighten the blank, so that the ends thereof are in squared relation with respect to the axis of the blank, before the forming operations are performed thereon. For the accomplishment of this straightening operation, I provide a die block 19 having a die cavity therein adapted to receive the blank 17. A die plunger 21 is arranged for movement into the die cavity 20 for applying pressure to the blank in the die cavity. The pressure thus applied straightens the blank and positions the end faces thereof in squared relation with respect to the axis of the blank. If desired, the bottom wall of the die cavity may be formed, in part, by the movable plunger 22 which serves the purpose of an ejector for lifting the blank out of the die cavity after the straightening operation has been performed. The die cavity may also be provided with a tapered portion 23 adjacent the lower end thereof for forming a chamfer 24 on the lower end of the blank.

After the straightening and squaring operation has been performed, the blank is transferred to a die cavity formed in the die block 26 and is there subjected to pressure by movement of the die plunger 27 toward the die block. The pressure thus applied to the blank results in the blank being upset or, in other words, results in the blank 17 being shortened and thickened into the substantially dome-shaped solid 28 shown in Fig. 4. According to my method, I cause the metal of the blank to flow during this forming operation so as to produce a plurality of upstanding lugs or castle prongs 29 at the upper end of the blank. For causing this flow of metal which results in the formation of the castle prongs 29, I provide the die plunger 27 with a plurality of recesses 30 which correspond in shape and number with the shape and number of the castle prongs desired on the blank.

The cavity of the die block 26, as shown in Fig. 1, is of somewhat larger diameter than the die cavity 20 so as to accommodate the increase in the diameter of the blank caused by the upsetting of the metal. If desired, the bottom wall of this die cavity may be formed, in part, by the plunger 31 which acts as an ejector for lifting the blank out of the die cavity. This die cavity is also provided adjacent the lower end thereof with a tapered portion 32 which forms a chamfer 33 at the lower end of the blank.

The die plunger 27 preferably includes a spring pressed plunger 34 which serves to strip the blank from the die plunger 27 when the latter is being moved away from the die block 26 to open the die cavity. During this forming operation which results in an upsetting of the blank and the formation of the castle prongs 29, the end walls of the die cavity, in this case the ends of the plungers 31 and 34, exert pressure on the ends of the blank to produce flattened areas or faces 35 and 35' in oppositely disposed relation on the dome-shaped solid. The castle prongs 29, formed by the die plunger 27, are disposed around the flattened area formed by the plunger 34, as shown in Figs. 4 and 7 of the drawing.

The blank is next subjected to a second forming operation wherein pressure applied in a die cavity forms the blank to the desired polygonal shape, such as that shown in Fig. 5. In the apparatus shown in Fig. 1 this second forming operation is performed in a die cavity formed in the die block 36. The cross-sectional shape of this die cavity corresponds with the polygonal shape desired for the finished nut and, in this instance, the cross-sectional shape of the die cavity is that of a hexagon. For exerting pressure on the blank in the die cavity of the die block 36, I provide a die plunger 37 which is of hexagonal cross-sectional shape and which is adapted to enter the die cavity. The bottom wall of the die cavity is preferably formed by a plunger 38, of hexagonal cross-sectional shape, which extends upwardly into the die cavity and which also serves the purpose of an ejector for discharging the blank from the cavity.

In this second forming operation it is desirable that the plungers 37 and 38 exert pressure against only a portion of the end faces of the blank so that the resulting substantially unrestricted flow of metal will leave chamfered areas on the nut. Accordingly, the plungers 37 and 38 are provided, respectively, at their adjacent ends with tapered projections 39 and 40 which are pressed into opposite ends of the blank and cause metal to flow or be displaced from the center of the blank into the sides thereof. The pressure applied to the blank, and the resulting flow of metal produced by the projections 39 and 40, cause the blank to be accurately formed to the desired hexagonal shape.

The plunger 37 is also provided at the lower end thereof with a plurality of recesses 41 which receive the castle prongs 29 of the nut blank and accurately form these prongs to the shape desired in the finished nut. These recesses of the plunger 37 are so located, with respect to the hexagon faces of the plunger and of the die cavity, that each of the hexagon faces of the nut blank is centered on one of the castle prongs, in other words, the hexagon faces are so formed on the nut blank during this operation that the corners of the hexagon are disposed opposite the slots or spaces between the castle prongs.

I have found that in carrying out my method the castle prongs can be made of increased height

and more accurately shaped if some of the metal of the blank 17 is initially displaced at the upper end thereof to form an upstanding flange 42, as shown in Fig. 3, which flange is divided or shaped during the first forming operation into the castle prongs 29. The upstanding annular flange 42 may be conveniently formed on the blank 17 by providing the die plunger 21 with a tapered extension 43 on the lower end thereof. During the straightening and squaring operation described above, this tapered extension is pressed into the end face of the nut blank thus forming a depression therein and leaving the metal of the blank upstanding around the depression.

It is usually desirable to provide the die plunger 21 with the tapered projection 43 because the formation of the upstanding annular flange 42 results in higher and more accurate castle prongs being formed, but it should be understood, however, that this feature is not altogether necessary in my novel method and, if desired, may be omitted.

After the second forming operation has been completed and the nut blank has been ejected from the die cavity of the block 36 by the plunger 38, the resulting nut blank is subjected to a piercing operation whereby excess metal is sheared or displaced from the center of the blank to provide the tap opening 12 therein. In forming this tap opening I provide a suitable die block 45, having an opening 46 therein, and a shearing punch 47 which is adapted to be forced through the nut blank and to displace excess metal therefrom into the opening 46 in the form of a metal slug 48. The die block 45 is preferably provided with an enlarged opening 49 beneath the opening 46 so that the slugs 48 may drop freely out of the die block after being pushed through the opening 46 by the punch 47. To facilitate withdrawal of the punch from the nut blank, a stripper plate 50 may be arranged to engage the nut blank and to hold the same against the die block while the punch is being withdrawn.

The castle nut as delivered from the piercing operation, and as illustrated in Fig. 6 of the drawing, is now ready to be tapped after which the finished nuts may be conveyed to a place of storage, or otherwise disposed of.

It will be understood that my method contemplates that the initial shearing of the blank from the bar stock, and all of the succeeding operations, are to be performed with the metal in an unheated state. Moreover, it should be understood that other apparatus than that herein illustrated may be used in performing the various operations, and if desired the blanks may be advanced from station to station by well known means, such as apparatus having automatically operated and controlled shifting fingers.

From the foregoing description and the accompanying drawing, it should now be understood that I have provided a novel form of castle nut and an improved method for the production of castle nuts wherein the prongs are formed on the nut blank during the upsetting operation. It will also be seen that during my improved method the polygonal faces of the nut are formed thereon after the castle prongs have been partially constructed, with the result that the faces of the nut can be accurately located with respect to the castle prongs and nuts of great uniformity can be economically produced. It will also be seen that the initial shaping of the nut blank to provide metal upstanding around a recess in one end thereof, results in the formation of castle prongs of accurate shape and of the desired height and size. Moreover, it will be seen that in the novel form of castle nut produced by my method, the castle prongs are located in substantially centered relation with respect to the nut faces with the nut corners opposite, and below, the slots which separate the prongs. With this arrangement the castle prongs present a large bearing surface for engagement with the retaining pin.

While I have illustrated and described my novel form of castle nut and my improved method of making castle nuts, in a detailed manner, it should be understood, however, that I do not wish to be limited to the precise operations and steps of procedure herein disclosed, but regard my invention as including such changes and modifications as do not involve a departure from the spirit of the invention and scope of the appended claims.

Having thus described my invention, I claim:

1. The method of making castle nuts which comprises applying endwise pressure to a section of stock to form a depression in one end thereof with an annular flange upstanding around the depression, upsetting said section and at the same time dividing the upstanding flange into castle prongs, forming the blank to desired shape and displacing metal from the central portion of the blank into the sides thereof, and then piercing the blank to form a tap opening therein.

2. The method of making castle nuts which comprises applying endwise pressure to a section of stock to form a depression in one end thereof with an annular flange upstanding around the depression, upsetting said section and at the same time dividing the upstanding flange into castle prongs, and then forming the blank to the desired nut shape.

3. The method of making castle nuts which comprises applying endwise pressure to a section of stock to form a depression in one end thereof with an annular flange upstanding around the depression, upsetting said section and at the same time dividing the upstanding flange into castle prongs, and then forming the blank to the desired polygonal shape with the corners thereof lying opposite the spaces between the pairs of adjacent prongs.

4. The method of making castle nuts which comprises shearing a section from a bar of stock to provide approximately the correct amount of metal required, applying pressure to the ends of said section to square said ends with respect to the axis of the section and at the same time forming a depression in one of said ends with metal upstanding around said depression, upsetting said section and at the same time shaping the upstanding metal into castle prongs, and thereafter forming corners on the blank by squeezing some of the metal of the blank out between each pair of adjacent prongs.

5. In a method of making castle nuts the steps of forming an upstanding annular flange on a nut blank, and then dividing the upstanding flange into castle prongs.

6. In a method of making castle nuts the steps of forming an upstanding annular flange on a nut blank, dividing the upstanding flange into castle prongs, and squeezing metal outwardly between each pair of prongs to form a corner.

7. The method of making castle nuts which comprises forming an upstanding flange on a section of stock, upsetting the section and dividing the flange into prongs, and forming the blank to nut shape.

8. The method of making castle nuts which comprises forming an upstanding flange on a section of stock, upsetting the section and dividing the flange into partial castle prongs with slots therebetween, and deepening said slots to complete the prongs and forming corners on the blank.

9. The method of making castle nuts which comprises forming an upstanding flange on a section of stock, upsetting the section and dividing the flange into partial castle prongs, completing the castle prongs and forming corners on the blank by displacing metal into the sides of the blank from the center thereof and from between the partial castle prongs.

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