

Nov. 20, 1923.

1,474,516

A. L. EICHER

METHOD OF FORGING GEAR WORMS

Filed Aug. 21, 1920

3 Sheets-Sheet 1

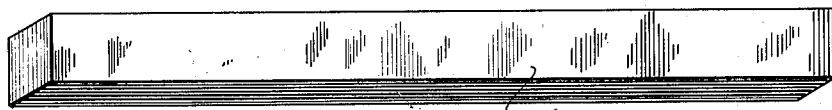


Fig. 1

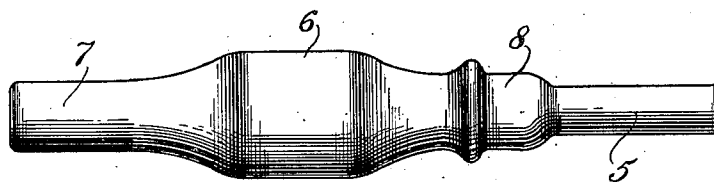


Fig. 2

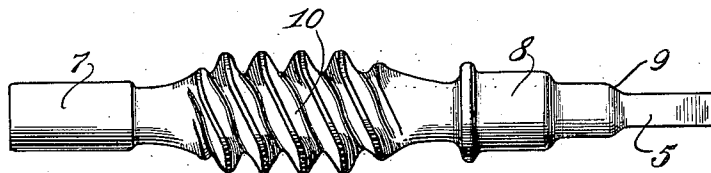


Fig. 3

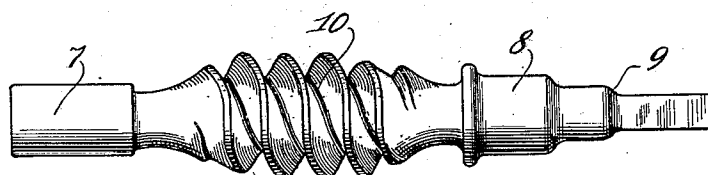


Fig. 4

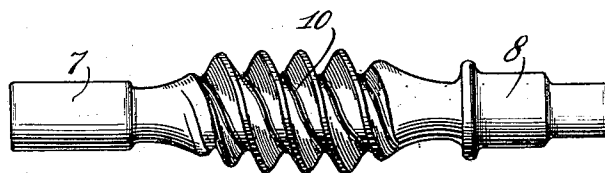


Fig. 5

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3 Sheets-Sheet 2

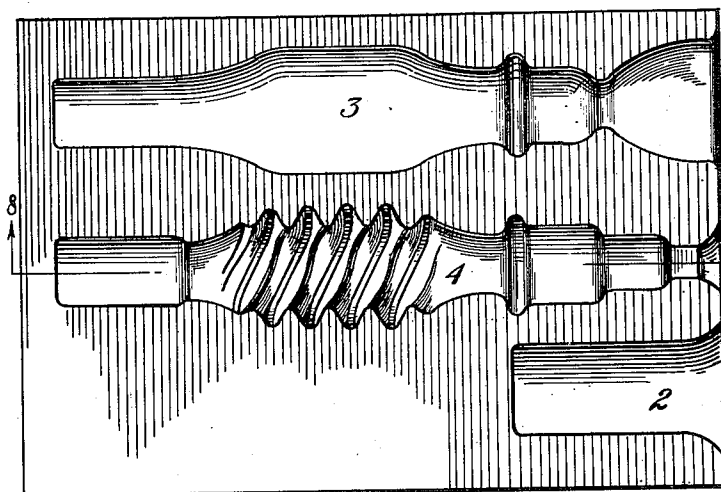


Fig. 6

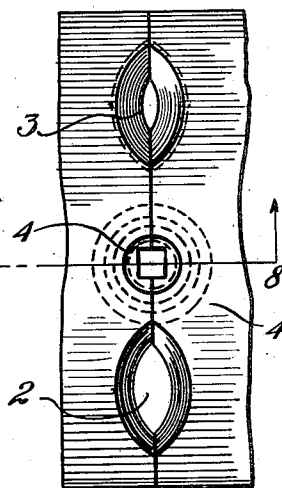


Fig. 7

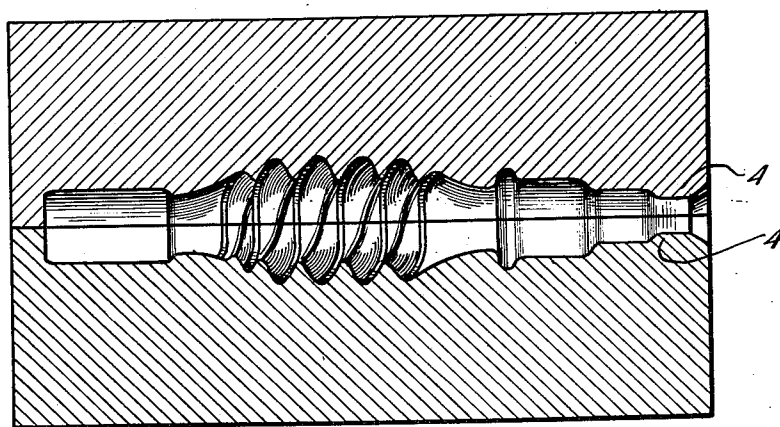


Fig. 8

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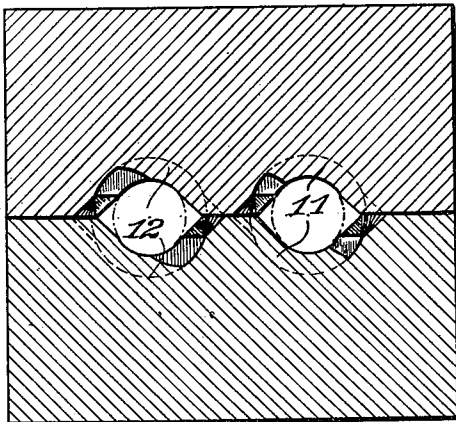
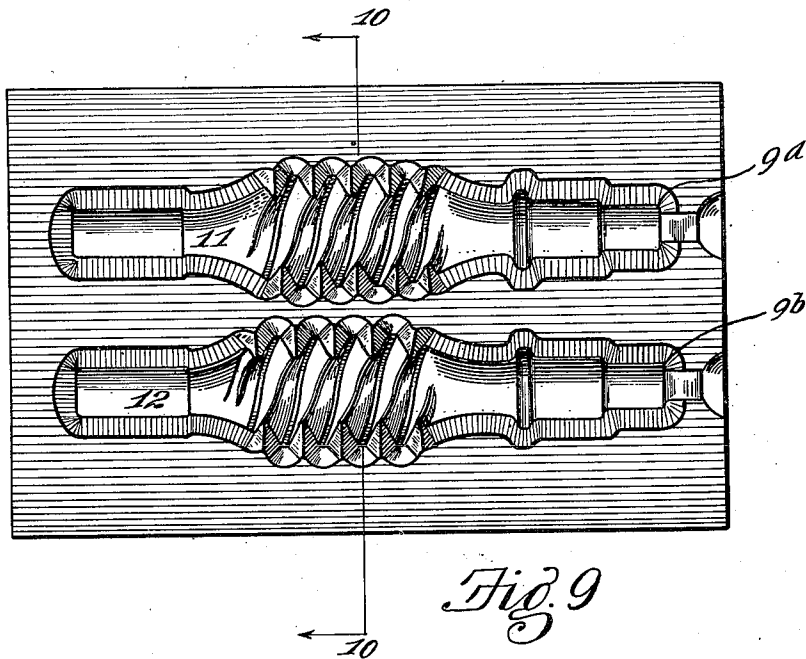
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METHOD OF FORGING GEAR WORMS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

ALBERT L. EICHER, OF CANAL FULTON, OHIO.

METHOD OF FORGING GEAR WORMS.

Application filed August 21, 1920. Serial No. 405,074.

To all whom it may concern:

Be it known that I, ALBERT L. EICHER, a citizen of the United States, and resident of Canal Fulton, in the county of Stark and State of Ohio, have invented a new and useful Improved Method of Forging Gear Worms, of which the following is a specification.

The invention relates to a method of drop forging worms for driving gears in tractors and like machines, and the object of the improvement is to forge the worms in such a manner that the grain of the metal is formed continuous, and parallel with the surface thereof, and so that the structure of the body or core of the metal within the worm will be homogeneous throughout.

In machining or forging gear worms by ordinary methods, difficulty is experienced in cutting across or distorting the grain of the metal with reference to the surface of the worm and also in rupturing or distorting the structure of the metal in the core or body of the worm, with the result of greatly reducing its efficiency and strength.

These difficulties are largely avoided by the present process in which the worm is first shaped by one set of forging dies which give the proper spiral pitch to diametrically opposite upper and lower portions of the worm, while slightly distorting the pitch of diametrically opposite lateral portions thereof; and then giving the distorted portions of the worm the correct spiral pitch, by quarter rotating the partially formed piece in another set of dies cut to act upon the upper and lower portions only of the partially formed worm.

The improved method of forging the worm thus set forth in general terms may be carried out by means of the dies and partial formations, illustrated in the accompanying drawings forming part hereof, in which—

Figure 1 is a perspective view of a blank bar from which the worm is formed;

Fig. 2, a plan view of the shape first given to the blank;

Fig. 3, a plan view of the preliminary formation given to the worm;

Fig. 4, a side view of the same showing the distorted side portions of the worm;

Fig. 5, a side elevation of the worm after it is completely formed with a true spiral pitch;

Fig. 6, a plan view of a lower block containing the dies employed in the preliminary formations of the worm;

Fig. 7, an end projection of the same showing also the upper block;

Fig. 8, a section through the upper and lower blocks containing preliminary dies on line 8—8, Figs. 6 and 7;

Fig. 9, a plan view of a block containing the lower dies for completing the forging process; and

Fig. 10, a section of an upper and lower block containing the completing dies, as on line 10—10, Fig. 9.

Similar numerals refer to similar parts throughout the drawings.

The worm is formed from a blank section of bar 1, and the ends of the blank are preferably first rounded in a swedging die 2, which may be cut in the same block containing the forming die 3 and the preliminary die 4; and in the swedging die, one end of the stock may be drawn out to give material for the guide shank 5.

The stock is then shaped by dies 3 to give the outline forms 6 for the worm, 7 and 8 for the bearing ends, and 5 for the guide shank; at the base of which shank is formed the shoulder 9 which may constitute the end of the completed worm after the guide shank is severed therefrom.

The worm proper 10 is then shaped around the entire stock by means of dies 4, which are cut in their middle portion to give the proper form and pitch to corresponding upper and lower portions of the worm; and are cut in their side portions to give the corresponding portions of the worm, the proper section of metal.

In order, however, to give the dies the necessary clearance draft, the side portions thereof are shaped to distort the pitch of the side portions of the worm, so that at each side the worm is substantially perpendicular to the plane of the face of the dies, as shown

in somewhat exaggerated form in Figs. 3 and 4.

In the same operation, the dies 4 give the guide stem 5 a square formation, with sides perpendicular to the face of the die, which stem is used as a guide for properly positioning the worm in the subsequent forging which is necessary for giving the worm the proper spiral pitch on all sides.

During the preliminary forging of the worm by dies 4, the stock is positioned therein without any rotating, and after the preliminary shaping of the worm, the fin which may be formed along each side by an excess of metal, is cut off in the usual manner by a trimming press, not shown; and the stock thus trimmed with the worm formed and shaped as shown in Figs. 3 and 4, is then ready for the final forging in dies 11 and 12, which are cut in the same blocks as shown in Figs. 9 and 10.

The finishing dies are shaped to give the final form and pitch in about three-fifths of the middle portion of the upper and lower sides, as the worm is positioned therein; while the side portions of these dies are cut away so as not to impinge the corresponding portion of the worm, thus limiting the forging action of the finishing dies to about three-fifths of the width of the upper and lower portions of the worm.

The full diameter portions of the worm in the dies 11 and 12 are cut exactly alike, but the end portions are shaped to give the proper taper to the worm when the stock has been rolled a quarter turn; and each worm die is likewise located a correspondingly different distance from the respective off-sets 9^a and 9^b which receive the end shoulders 9 at the base of the guide stem, so that by abutting these off-sets by the end shoulder 9 as the stock is passed from one die to the other, the worm will have the proper longitudinal position with reference to the respective dies.

In giving the worm the final forging, the stock is first given one or more blows in die 11, in which it is given a quarter turn from the position in which the preliminary formation was made, which position is made certain by the square of the guide shank, and is determined by the eye of the operator as well as by the squared recess in the block. This quarter turn brings the distorted portions of the worm to the top and bottom of the stock, to be directly acted upon by the middle portions of the dies 11, which rectify the distorted portions of the worm and give them the true pitch.

It is evident however, that the proper aligning of the distorted portions of the worm will tend to a certain extent to distort the lateral portions of the worm as positioned in dies 11, because these dies are so cut away that they do not support these

portions of the worm; and to rectify any distortion of the worm which may thus occur, the same is next rotated a quarter turn and given one or more blows between dies 12, in which the stock is given the same position as it was placed in the preliminary forging in die 4.

As dies 12 do not support the lateral portions of the worm, they may be again distorted somewhat by the realignment of the upper and lower portions by this die, and to rectify such distortion the stock is rotating a quarter turn back again and given a further forging between dies 11; which rotating operation between dies 11 and 12 is repeated until the entire worm is given its proper pitch, as shown in Fig. 5, thereby completing the forging operation; after which the guide stem may be severed, and the worm is ready for the final heat treating and machining operations.

By the described method of forging the worm, it will be noted that the formation of the worm with a slightly distorted pitch, and the displacement of metal caused thereby, are completed by the preliminary operations in dies 4, and that the resulting grain of the metal in the worm will be substantially parallel the wearing surface thereof; and it is evident that the subsequent operation of giving the partially distorted worm its proper pitch by means of dies 11 and 12, the previously formed worm is merely deflected from its distorted position without injuriously affecting the grain of the metal.

A further advantage of the present improvement, is that the entire process of forging from the blank bar to the completed worm can be and is carried out by a single heating of the stock; thus avoiding the deteriorating action of a reheating of the same, especially upon the surface wearing portion of the worm.

I claim:

1. The method of forging gear worms which consists in first shaping the worm with a distorted pitch and then rectifying the alignment of the same.

2. The method of forging gear worms which consists in first shaping the worm with a distorted pitch along diametrically opposite sides, and then rectifying the alignment of the distorted portions.

3. The method of forging gear worms which consists in first shaping the worm with dies which distort the pitch on laterally opposite sides, and then rectifying the pitch by intermittently forging and alternately rotating in other dies acting only upon portions of the worm.

4. The method of forging gear worms which consists in first shaping the worm with dies which distort the pitch on laterally opposite sides and form a guide stem on

one end squared to correspond to the distorted portions of the worm, and then rectifying the pitch by intermittently forging and alternately rotating in other dies acting only upon portions during the intermittent forging of the worm, by reference to the squared guide stem.

5. The method of forging metal gear worms which consists in first heating the metal and then shaping the worm with a distorted pitch and rectifying the alignment of the same without further heating. 10

ALBERT L. EICHER.