April 16, 1940. C. G. OLSON 2,197,732

THREAD ROLLING DIE AND METHOD

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FIG. 1.

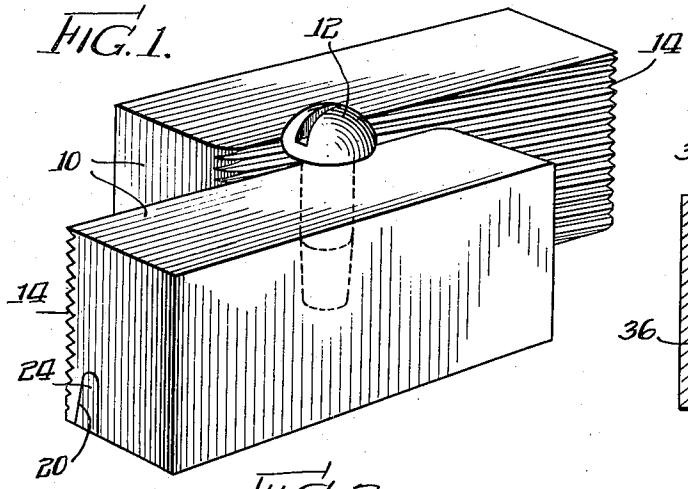


FIG. 4.

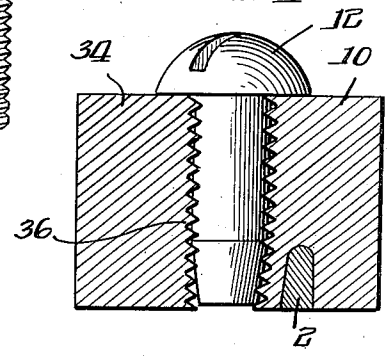


FIG. 2.

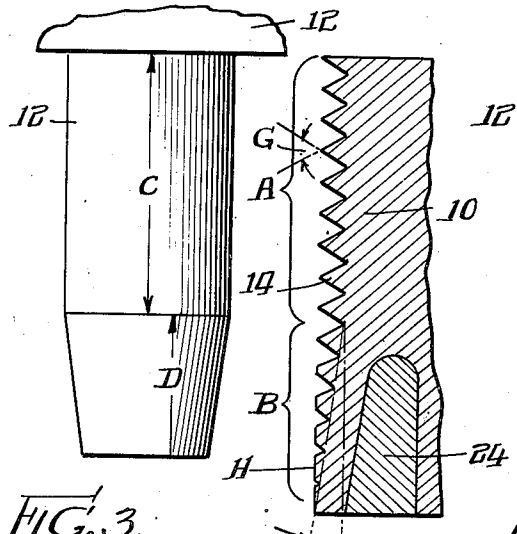


FIG. 5.

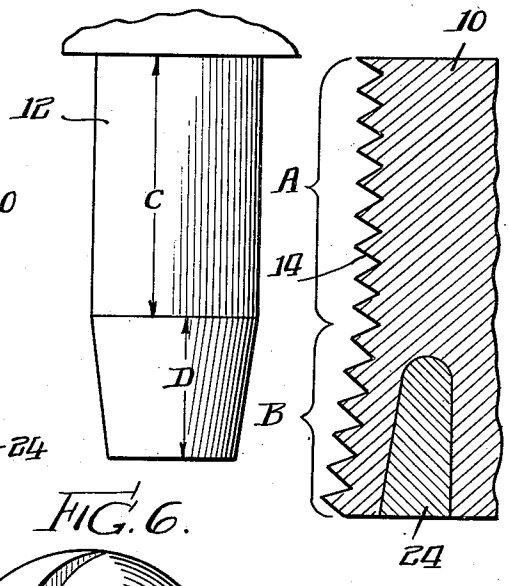


FIG. 3.

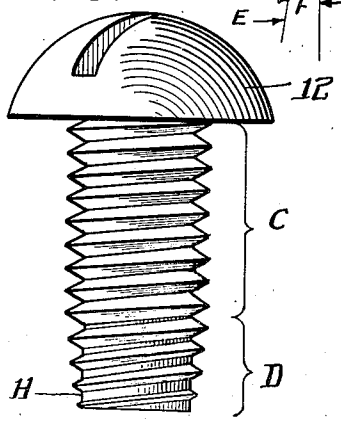
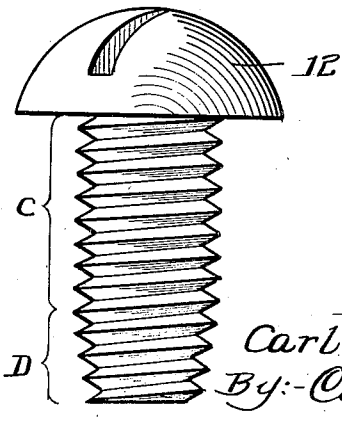


FIG. 6.



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THREAD ROLLING DIE AND METHOD

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FIG. 7.

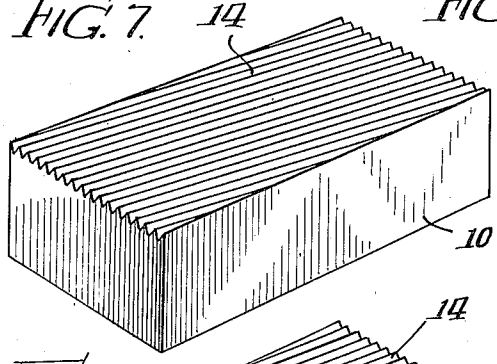


FIG. 14.

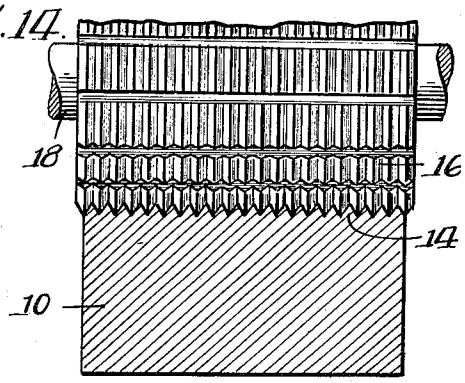


FIG. 8.

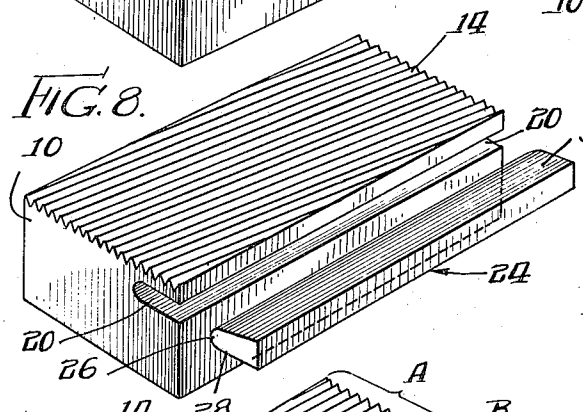


FIG. 11.

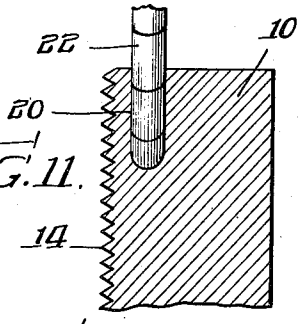


FIG. 9.

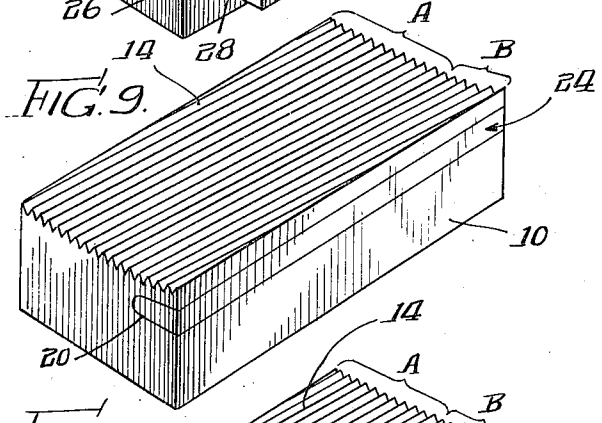


FIG. 12.

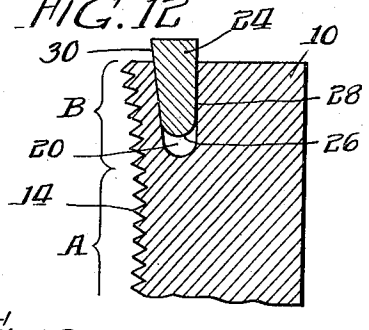


FIG. 10.

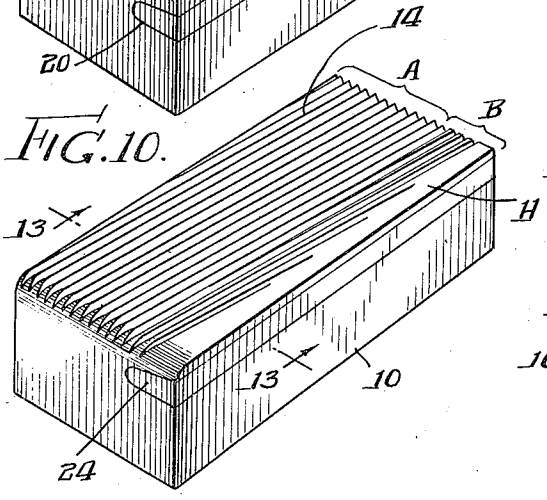
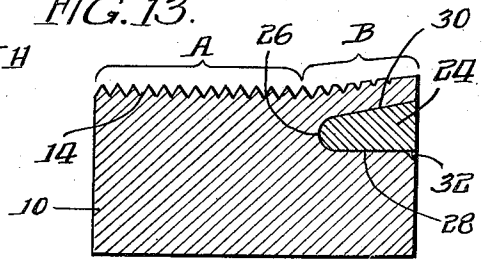


FIG. 13.



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UNITED STATES PATENT OFFICE

2,197,732

THREAD ROLLING DIE AND METHOD

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Application March 12, 1938, Serial No. 195,584

16 Claims. (Cl. 76—107)

This invention relates to thread forming mechanism, and more particularly to dies for the forming of screw threads of the type adapted for screws designed to form their own threads in unthreaded apertures of relatively hard material.

It is an object of the present invention to provide a simple and improved method for the construction of thread forming dies having configurated work surfaces which are curved or otherwise warped out of a flat plane surface over preselected portions thereof.

The present invention relates more specifically to thread forming dies for rolling threads on fastener blanks, which threads are tapered inwardly toward the axis of the fastener adjacent the entering end. Heretofore die blocks of this class have been provided by machining the work surfaces to the desired configuration. While no considerable problem is involved in providing flat or regular work surfaces of the die with parallel serrations complementary to threads on the finished fastener, special tools and machinery have been necessary in order to specially configurate other sections of the work surface in which the serrations are of varying depth or wherein certain of the serrations are relatively displaced out of the normal plane of the surface.

It is accordingly an object of the present invention to provide a method for forming dies of the above class wherein the thread forming serrations throughout the work surface of the die block may be provided by simple, known forming operations and wherein the relative displacement of the desired portions of the serrations is effected by bodily displacing these selected portions of the die block so that when a screw blank is engaged by the work surface counterparts in the form of a thread of varying height or position with respect to the axis of the fastener will be formed.

Another object of the invention is to provide a method, as above, wherein the thread forming serrations are provided uniformly throughout the work surfaces of the die blocks before relative displacement of preselected portions thereof, and wherein subsequent forming of the displaced serrated edge is effected for the purpose of varying the effective height of the threads and/or the relative diameter of the fastener adjacent these portions and die.

The invention further contemplates the provision of the improved dies resulting from the above methods, and in addition comprehends the provision of an improved thread rolling device which is particularly useful in shaping thread forming screws as well as fasteners having a so-called gimlet point, which device comprises a combination of dies in opposed thread rolling relationship, wherein one only of the dies is provided with relatively displaced thread sections.

Numerous other objects and advantages will be more apparent from the following detailed description when considered in connection with the accompanying drawings, wherein—

Fig. 1 is a perspective view of a pair of thread rolling dies of the type contemplated by the present invention, a partially rolled screw blank being shown in operative association with the working faces of said dies;

Fig. 2 is an enlarged vertical sectional view of one of the dies of Fig. 1 positioned adjacent a screw blank which is adapted to be rolled by said die;

Fig. 3 is a side elevational view of the screw after it has been rolled between dies of the type shown in Figs. 1 and 2;

Fig. 4 discloses a pair of dies of slightly modified cross-sectional form, engaging a screw blank in the process of rolling the threads thereon;

Fig. 5 discloses a die shown in the righthand side of Fig. 4, the die being shown positioned adjacent a screw blank adapted to be rolled by said die;

Fig. 6 discloses a side elevational view of the screw after it has been rolled by the dies shown in Figs. 4 and 5;

Figs. 7 to 10, inclusive, are perspective views of a die block, showing the structure of the block at several stages during the manufacture thereof, as well as showing the finished die block;

Fig. 11 is a detail perspective elevation taken through the die block and indicating the manner of cutting the slot adjacent the edge thereof prior to displacing preselected portions of the work face;

Fig. 12 is a detail sectional elevation showing the relation of the parts at the time the spreading wedge is driven into the slot;

Fig. 13 is a sectional elevation taken on the line 13—13 of Fig. 10; and

Fig. 14 is a sectional elevation through the serrated block showing the position and arrangement of the cutter in producing the serrations.

Referring now to the drawings more in detail where like numerals have been employed to designate similar parts throughout the various figures, it will be seen that the invention contemplates means in the form of dies or die blocks 10, constructed in accordance with the present invention and arranged for practicing my im-

proved method of thread rolling. The die blocks 10 are preferably of a size and shape which enables them to be mounted in a conventional thread rolling machine (not shown). In these conventional machines one of the dies is held in fixed position and the other is reciprocably mounted. In Fig. 1 the foremost die block is stationary, whereas the rearmost die is reciprocable.

A screw blank, indicated generally by the numeral 12, is adapted to be rolled between the working faces 14 of the die blocks, the blank being initially positioned at the right end of the front block, the reciprocable die block serving to grip the blank and roll it between the working surfaces 14.

The structural characteristics of the working surfaces of the dies shown in Figs. 1 and 2 are substantially the same as have been described in my earlier filed co-pending application, Serial No. 152,328, filed July 7, 1937, which application describes and claims the method of making thread forming fasteners with dies of this character, as well as one method of forming the desired work surfaces.

Attention is called to the fact that each working surface 14 comprises a plurality of serrations which are inclined with respect to the horizontal in accordance with the desired thread angle in the completed screw. The serrations on each working surface 14 may be divided into two distinct groups, one group being indicated by the bracket A, Fig. 2, and the other group by the bracket B in Fig. 2. The group A constitutes parallel serrations of constant height which, when impressed within the corresponding portion C of the screw blank 12, produces threads of constant height and constant root diameter, as indicated by the bracket C in Fig. 3. This portion C of the screw may properly be referred to as a holding portion because this is the part of the screw which is held within the work.

The portion B of the die 10 includes serrations which gradually diminish in height with respect to the plane in which reside the crests of the constant height serrations included within the bracket A in Fig. 2. In other words, attention is particularly directed to the fact that all of the serrations included within the bracket A are of uniform shape and dimension and have their root portions arranged in the same flat plane. The serrations denoted by the bracket B have their root portions arranged in a plane indicated by the line E, making the angle F with the plane of the root portions of the remainder of the serrations. The included angle of the serrations on the die indicated by the letter G, Fig. 2, remains constant throughout the sections A and B so that the recesses between the various serrations have a V bottom of constant cross-section.

In addition to the foregoing structural characteristics it will be noted that the outer surfaces or crests of the serrations included within the zone B are provided with flat surfaces H coincident with a line passing through the crests of the serrations A and that the root portions on the serrations in section B gradually approach this line.

It will be understood from the above disclosure that when the die 10 in Fig. 2 is impressed in the surfaces of the screw blank 12 the portions C and D thereof are both formed with threads having the same included thread angle, while the flat surfaces H of the ribs or serrations on the sections B produce corresponding exposed peripheral core surfaces H on the screw in Fig. 3, said exposed core surfaces H being of the same diameter as the root diameter of the body portion C of the screw and increasing in width as the threads decrease in height.

The present invention contemplates the novel steps for providing and forming a die of the above character, as well as equivalent dies adapted to specially form the entering end of screw threaded fasteners.

Referring more particularly to Figs. 7 to 14, it will be seen that the present invention contemplates a series of steps requiring no special machinery or tool other than a standard thread milling hob or cutter. The block 10, shown in the figures and illustrating one method of carrying out the present invention, originally comprises a rectangular block of metal having flat, regular surfaces. The numeral 16 designates a cutter having straight rows of teeth corresponding to the pitch of the threads required on the die. The cutter 16 is mounted on a shaft 18 of a milling machine (not shown) and the block 10 is appropriately secured to the work engaging surfaces of the same machine by means not shown. It will be understood from the above that the block will be arranged at a slight angle with respect to the plane of the teeth of the cutter 16 equal to the thread angle on the finished screw. In other words, the relative position of the block 10 and the cutter 16 is such as to produce the inclination of the serrations from the horizontal, clearly shown in Fig. 1.

The effect of the milling operation shown in Fig. 14 is to provide the flat upper surface of the block with the serrations 14, as shown in Fig. 7, each of the serrations being parallel, of the same pitch and height, and having the same included angle. In other words, the serrations are uniform in character and are regularly positioned over the entire upper surface of the block. It will be understood that the above defined milling operation is disclosed merely for illustrative purposes, showing one way in which the serrated surface can be formed and that the invention comprehends the provision of the serrated surface by the use of any known forming or shaping means capable of producing serrations.

It will be apparent that the block, in its present state, will not be suitable for providing tapered thread sections adjacent the entering end of the fastener. In order to displace the serrations on the preselected portions of the die corresponding to the entering portions of the fastener, the edge of the block is first provided with a longitudinal slot 20, clearly shown in Fig. 8. It will be noted that the slot 20 is slightly to the rear of and substantially parallel with the plane of the surface upon which the threads or serrations have been milled. Moreover, this slot is preferably closer to the milled or top surface of the block, as viewed in the figures, than it is to the bottom surface, for a reason which will hereinafter appear in detail. The slot 20 may be formed by means of an ordinary milling cutter 22. It should be noted that the die block blank is now divided by the slot into a rigid section and a yieldable section positioned between the side of the slot and the top surface of the die, and that the area of the yieldable section corresponds with the extent of the section B of the die, which has been hereinbefore described in detail.

A strip of material 24 is provided, having a generally wedge-shaped cross-section, as shown in Figs. 12 and 13. According to the preferred

arrangement disclosed in the figures, the wedge-shaped strip has a curved entering edge **26** corresponding with the curved bottom of the groove **20**. The strip has a lower surface **28** generally coextensive with the bottom surface of the groove, as viewed in Fig. 8, for example. The upper surface **30**, however, is arranged at an angle with respect to the surface **28**, corresponding generally to the angle F, hereinbefore mentioned. Accordingly, it will be obvious that when the wedge-shaped strip **24** is forced into the slot **20** to fill the slot, as shown in Fig. 9, the yieldable portion of the block indicated generally by the bracket B in Fig. 9 will be displaced bodily through an angle generally represented by the angle F. At this point it will be noted that the root portions of the serrations B are likewise arranged at the angle F with respect to the root portions of the serrations in the zone A, but that the remaining portions of the serrations are all correspondingly elevated above the equivalent parts of the undisplaced threads.

In order to provide the flattened surfaces H, the block shown in Fig. 9 may be mounted in any suitable milling or grinding machine, and the protruding or raised portions of the displaced serrations removed level with the plane of the crests of the serrations A. The wedge-shaped strip **24** may be retained in place by welding **32**, as indicated in Fig. 13. At this juncture the die block has the form indicated in Fig. 10, which is identical with the structure shown in Figs. 1 and 2.

It is understood, in accordance with the above disclosure, that the die will preferably be heated to a dull red at the time the wedge-shaped strip **24** is pressed into the slot **20** to facilitate forming of the yieldable section. It is contemplated that the die be hardened in the usual manner before being used to roll threads. According to an alternative modified procedure, the wedge-shaped strip **24** may be removed from the slot **20** after the yieldingly supporting section B has been displaced to the required degree, and the slot subsequently filled up with welding metal, for example. When proceeding in this manner it has been found preferable to thoroughly anneal the entire blank after completion of the welding operation and before hardening.

A screw forming die, as disclosed in Figs. 4 and 5 is provided for the purpose of rolling thread forming fasteners of the type shown in Fig. 6 wherein the entering portion D of the fastener is provided with threads of the same height as the body portion C of the fastener, but wherein the entering portion tapers, due to the gradual convergence of the root portion toward the axis of the fastener.

It will be apparent from the previous disclosure that the die shown in Figs. 4 and 5, for producing this result, is substantially the same as the die hereinbefore described, with the exception that the serrations over the portion B, as shown in Fig. 5, are of the same height and form as the serrations on the portion A, being completely undeformed or mutilated.

This thread forming means will be provided identically in accordance with the method of the previous embodiment, with the exception that the step indicated in Fig. 10, namely that of grinding or machining the raised thread surfaces, is omitted. In other words, Fig. 9 represents the finished form of the die suitable for producing the fastener shown in Fig. 6.

Attention is directed in particular to the arrangement of die blocks shown in Fig. 4 wherein the right-hand die **10**, as shown in the figure, corresponds to that described in connection with Fig. 5. The opposed die block **34**, on the other hand, is provided with a work surface wherein the serrations **36** are all of uniform character and are arranged in the same flat plane. It is important to note that the thread forming dies shown in Fig. 4 are represented as being in the position in the thread rolling machine and are actuated in the manner before mentioned to roll threads upon the blank **12**, shown in Fig. 5, and produce a fastener shown in Fig. 6. Thus, it is not essential to deform both work surfaces in accordance with the tapering entering portion of the fastener. As a result, the work surfaces of the dies are not only greatly simplified, but the present process permits the rolling of fasteners having relatively sharp points, such as wood screws, or fasteners with the so-called gimlet point, without specially configurating the work surfaces of the dies to prevent their interengagement.

In considering the disclosure in the drawings it should be borne in mind that the degree of taper or deformation of the so-called resilient portion of the dies are only illustrative. In other words, in the practical embodiment these dimensions and specific structural details may be departed from without digressing from the invention. For example, the resilient portion B of the die block may be displaced in a curved plane, if desired, by merely properly shaping the strip of material **24**. Moreover, the serrations may be machined or ground to any form corresponding to a preferred thread formation on the finished fastener.

It is thought that the present invention provides a highly simplified and effective method for manufacturing thread forming fasteners, and in particular for providing dies suitable for rolling the preferred thread on these fasteners. In accordance with this invention all difficult and unusual forming operations are omitted and production is expedited and rendered inexpensive through the fact that the necessary operations consist of elementary and highly simplified machining and shaping steps.

Numerous changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention or sacrificing any of its advantages, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations along the surface of a metallic blank and bodily displacing a predetermined section of the said surface of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations.

2. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, providing a yieldable portion for said blank. said yieldable portion comprising a part at least of said serrated surface, and bodily displacing said yieldable portion of the metallic blank compris-

ing serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations.

3. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, bodily displacing a yieldable portion of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations, and rendering said displaced yieldable section rigid with the remainder of the blank.

4. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, bodily displacing a yieldable portion of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations, and further forming the repositioned serrations to control the root dimension of the threads formed thereby.

5. The method of making a thread forming die which comprises providing a die blank having a plurality of thread forming serrations along a surface thereof, bodily displacing a portion only of the surface of the die blank in a direction laterally out of said surface and with respect to the remainder of the blank for bodily repositioning the serrations on the said section laterally of the plane of the remainder of the serrations.

6. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, providing a predetermined yieldable portion for said blank, said yieldable portion comprising a part at least of said serrated surface, and bodily displacing said yieldable portion of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations.

7. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, providing a yieldable portion for said blank, said yieldable portion comprising a part at least of said serrated surface, bodily displacing said yieldable portion of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations, and rendering said displaced yieldable section rigid with the remainder of the blank.

8. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations of uniform bottom cross-section along the surface of a metallic blank, providing a yieldable portion for said blank, said yieldable portion comprising a part at least of said serrated surface, bodily displacing said yieldable portion of the metallic blank comprising serrations so formed in a direction laterally and outwardly of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations, and further forming the repositioned serrations to control the root dimension of the threads formed thereby.

9. The method of making a thread forming die which comprises providing a die blank having a plurality of thread forming serrations along a generally flat surface thereof, bodily displacing a predetermined portion only of the surface of the die comprising serrations so provided with respect to the remainder of the serrations by providing a cut-away portion rearwardly of said predetermined portion of the surface for rendering said predetermined portion readily displaceable, and forcing the said predetermined portion of the surface laterally outwardly of its plane.

10. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations along the surface of a metallic blank, providing a yieldable portion adjacent the said serrated surface by removing supporting material from the block rearwardly thereof, and bodily displacing said yieldable portion of the said surface of the metallic blank comprising serrations so formed in a direction laterally of said surface and with respect to the remainder of the blank in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations.

11. The method of forming a thread rolling die which comprises the steps of forming a plurality of parallel serrations along the surface of a metallic blank, providing a yieldable portion adjacent the said serrated surface by removing supporting material from the block rearwardly thereof to form a slot parallel to said surface, and bodily displacing a portion of the said surface of the metallic blank in a direction laterally of said surface by driving a wedge-shaped member into the slot in order to bodily reposition the serrations on the said section with respect to the remainder of the parallel serrations.

12. A thread rolling die, including a block having a working surface, said working surface including a pair of zones comprising thread forming serrations and formed on an integral side portion of said block, one said zone of the surface being bodily displaced laterally outwardly of said block by distortion of the adjacent side portion with respect to the plane of the other said zone whereby to form a laterally offset thread forming portion adapted to shape a narrowed portion of a screw blank.

13. Thread forming mechanism including a metallic block having a working surface, said working surface including a zone comprised of thread rolling serrations, and a second zone having thread rolling serrations, said second zone of said surface being displaced outwardly of said block with respect to the plane of said first named zone, and an insert in said block retaining the second zone in displaced position.

14. Thread forming mechanism including a metallic block having a working surface, said working surface including a zone comprised of elongated, parallel, V-shaped serrations of constant depth, and a second zone having elongated, parallel, V-shaped serrations, a slot formed below the surface of said second zone and spacing

the material of said zone from the block, the material of said zone being displaced bodily outwardly with respect to the block, and an insert in the slot retaining the material of the second zone in displaced condition whereby to provide a die block for rolling threads on a fastener having thread sections varying with respect to the axis of the fastener.

15. Thread forming mechanism including a metallic block having a working surface, said working surface including a zone comprised of elongated thread rolling die teeth of constant height, and a second zone provided with elongated die teeth of constant height, the root portions at least of which reside in a plane angularly displaced with respect to the plane of the root portions of said first mentioned thread rolling die teeth, and a metallic insert in the block rearwardly of said second zone and retaining the said root portions in said displaced position.

16. A thread rolling die having a working surface, said working surface including a zone comprising thread forming serrations, a second zone on said working surface being provided with additional thread forming serrations the root portions at least of which reside in a plane angularly disposed with respect to the plane of the root portions of said first-mentioned thread forming serrations and an insert in said block associated with said second zone and retaining said root portions in said angularly disposed position.

CARL G. OLSON.

CERTIFICATE OF CORRECTION.

CERTIFICATE OF CORRECTION.

Patent No. 2,197,732. April 16, 1940.

CARL G. OLSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 44, claim 11, after the word "laterally" insert --and outwardly--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of June, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)