June 2, 1942. R. T. HOSKING 2,284,659

THREAD ROLLING DIE

Filed May 25, 1940 2 Sheets-Sheet 1

FIG. 1.

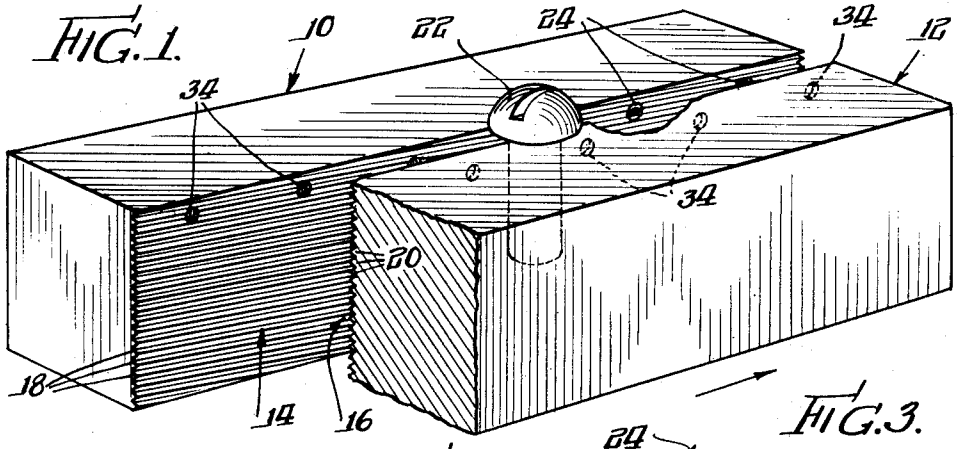


FIG. 2

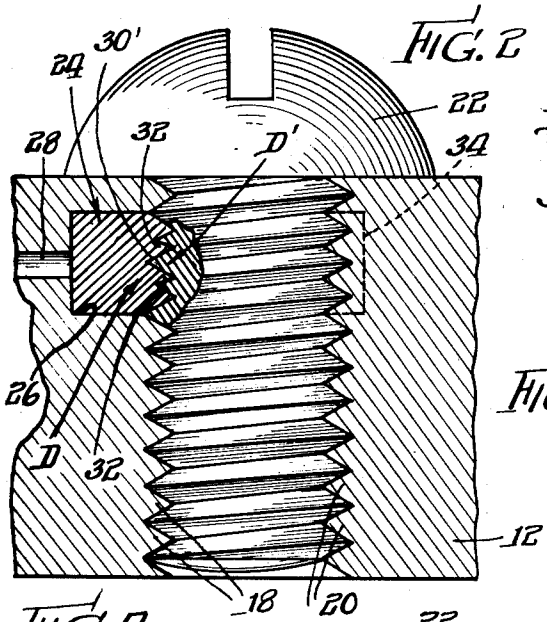


FIG. 3.

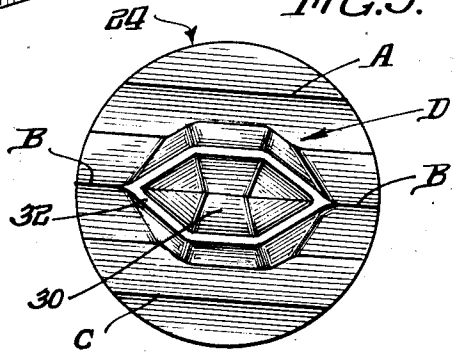


FIG. 5.

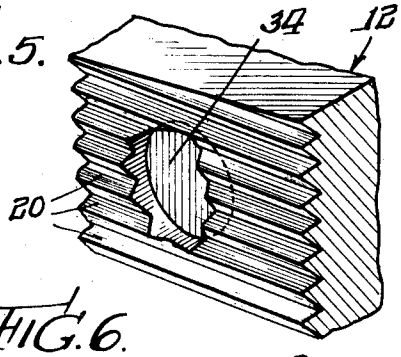


FIG. 4.

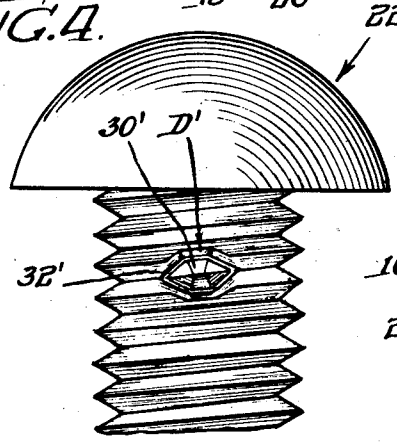
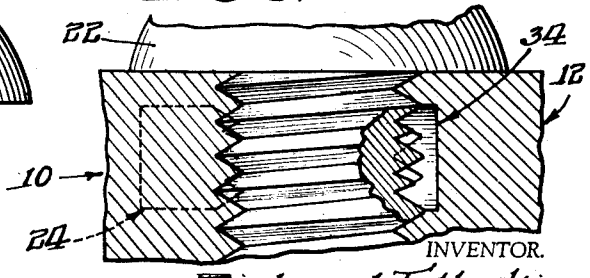


FIG. 6.



INVENTOR.

BY: Richard T. Hosking

Cox & Moore

ATTORNEYS.

June 2, 1942. R. T. HOSKING 2,284,659

THREAD ROLLING DIE

Filed May 25, 1940 2 Sheets-Sheet 2

FIG. 7.

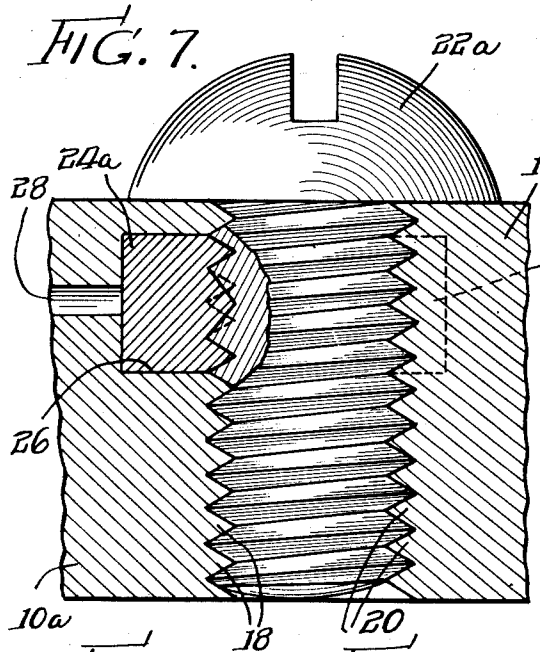


FIG. 8.

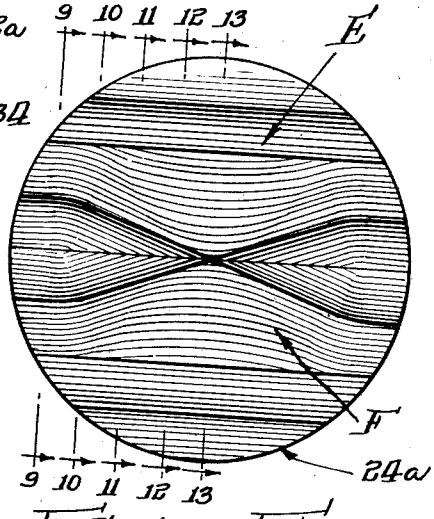


FIG. 9.

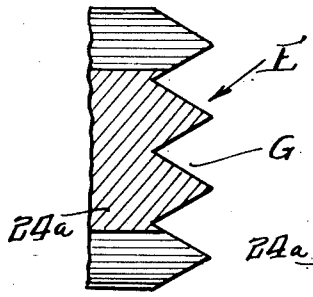


FIG. 10.

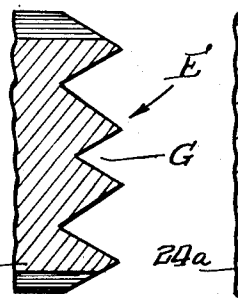


FIG. 11.

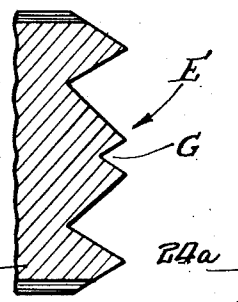


FIG. 12.

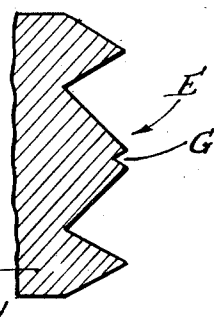


FIG. 14.

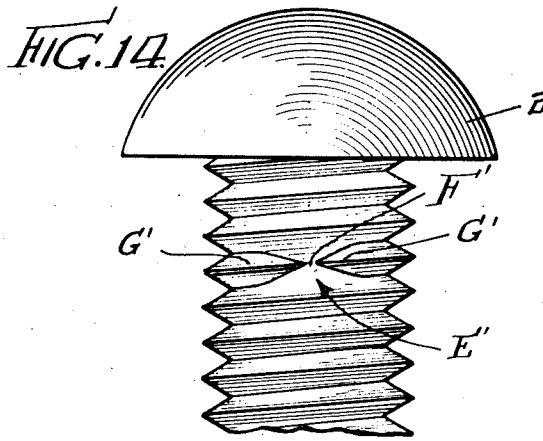
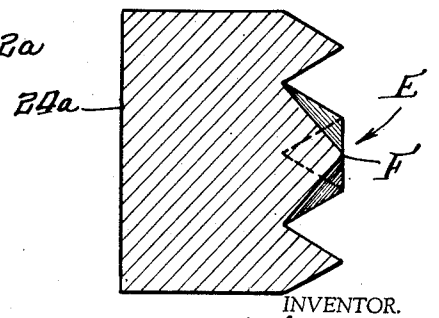


FIG. 13.



INVENTOR.
Richard T. Hosking
BY: Cox & Moore
ATTORNEYS.

Patented June 2, 1942

2,284,659

UNITED STATES PATENT OFFICE

2,284,659

THREAD ROLLING DIE

Richard T. Hosking, Wilmette, Ill., assignor, by mesne assignments, to Illinois Tool Works, Chicago, Ill., a corporation of Illinois

Application May 25, 1940, Serial No. 337,259

15 Claims. (Cl. 80—9)

This invention relates generally to thread rolling dies and more particularly to die mechanisms whereby thread convolutions and a thread locking section may be produced simultaneously.

It is an important object of the present invention to provide mechanism whereby self-locking screws may be very economically produced and to this end the invention contemplates die mechanism equipped with means for producing thread convolutions and means for simultaneously producing a locking section in a thread convolution whereby when the screw is applied to a threaded work piece, a section of the thread in the work piece will be displaced axially so as to secure the screw against inadvertent loosening.

More specifically, the invention contemplates a die mechanism as set forth above which will produce a screw having a rolled thread and a section positioned out of helical alignment of said thread which will function when the screw is turned within a threaded work piece to cause a complementary section of the thread in the work piece to shift axially.

Still more specifically, the present invention contemplates a die arrangement as outlined above wherein thread producing ridges are altered in shape at spaced intervals so as to produce on the screw blank intermediate adjacent convolutions thereof a locking section which when rotated within a threaded work piece will effect the axial displacement of the crest of the thread in the work piece.

Another object of the invention is to provide thread forming mechanism or apparatus of the type set forth above wherein the portion employed to produce the locking section in the screw blank constitutes an insert within a die block.

It is a further object of the present invention to provide in a thread rolling die, means adapted to form at a point intermediate adjacent thread convolutions in a screw blank an element which when hardened and rotated within a threaded work piece will actually sever and axially displace a portion of the thread convolution in a work piece so as to render the screw self-locking.

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

Fig. 1 discloses a perspective view of a pair of thread rolling dies and an associated screw blank, said dies being constructed in accordance with the teachings of the present invention, the shiftable die being broken away so as to more clearly expose the structure of the working face on the stationary die;

Fig. 2 is an enlarged vertical sectional view taken centrally of the screw element at a point where one of the die inserts is completing the formation of a locking section in the screw blank;

Fig. 3 is an enlarged front elevation of one of the die inserts to more clearly illustrate the structural arrangement thereof;

Fig. 4 is a fragmentary side elevational view of a completed screw element showing the location of the locking section produced during the thread rolling operation;

Fig. 5 is a fragmentary perspective view of the recess portion of the die member which permits clearance of the locking section produced by the inserts in the other die member;

Fig. 6 is a view similar to Fig. 2 disclosing the manner in which the recesses in the die block of Fig. 5 provide clearance for the thread locking section in the screw produced by the inserts in the other die block;

Fig. 7 is a view similar to Fig. 2 disclosing a die insert of modified form for producing a modified locking section in a screw blank;

Fig. 8 is an elevational view of the die insert of Fig. 7 as viewed from the right of Fig. 7 when the screw element is detached therefrom;

Figs. 9 to 13, inclusive, are transverse sectional views of the die insert taken along the lines indicated in Fig. 8; and

Fig. 14 is an elevational view of a screw having a locking section produced by the die insert shown in Figs. 7 to 13, inclusive.

Referring now to the drawings more in detail wherein like numerals have been employed to designate similar parts throughout the various figures, it will be observed that the present invention contemplates die mechanism which includes a pair of relatively reciprocable die members or blocks 10 and 12. In the disclosed embodiment I have shown the block 10 as the stationary die and the block 12 as the movable die. The die 10 is provided with a working surface 14 and the die 12 is provided with a working surface 16. The working surface 14 includes a plurality of ridges or die serrations 18 and the working surface 16 is provided with a plurality of identical serrations or ridges 20. These ridges conform in transverse cross-section with the cross-sectional shape of the thread which is desired to be produced in a screw blank 22. The diameter of the shank on the screw blank is substantially equal to the pitch diameter of the finished screw so that when the blank is rolled between the work

surfaces 14 and 16, the ridges or teeth 18 and 20 indent the periphery of the screw blank and cause a portion of said periphery to flow outwardly so as to fill the recesses between the serrations.

The present invention is particularly concerned with the formation of a locking section in the screw blank simultaneously with the thread rolling operation just described. This is accomplished by the use of a series of die inserts designated generally by the numeral 24. These inserts are of cylindrical shape and are snugly fitted within complementary cylindrical apertures 26 provided within the die block 10. An elongated aperture 28 which traverses the die block 10 and communicates with the aperture 26 serves to facilitate removal of the inserts 24.

The structural features of the inserts 24 are best shown in Figs. 2 and 3. Fig. 3 discloses an enlarged elevational view of one of the inserts. It will be noted that the letters A, B and C designate ridge portions of the insert which form continuations of complementary ridges or serrations in the die block 10. It will also be noted that the ridge portion B is interrupted by a section designated generally by the letter D, this section D forming a counterpart of the locking section to be produced in the screw blank. This locking section is indicated generally by the letter D' in Fig. 2. The section D comprises a central recess 30 which produces a complementary protuberance or projection 30' in the screw blank 22. The section D also includes a circuitous projection or ridge 32 which produces a complementary circuitous depression 32' of the locking section D', Fig. 4.

The die blocks 10 and 12 are provided with a series of cylindrical recesses or depressions 34. Three of these recesses are provided on the die block 10 and a greater number on the die block 12. In initiating the rolling of the screw blank 22, the shiftable die block 12 occupies its retracted position, namely, to the left of Fig. 1. The blank is fed to the left extremity of the stationary die block 10 and as the die block 12 moves forwardly (to the right, Fig. 1), the serrations or ridges 18 and 20 cooperate in initially forming the thread convolutions on the screw blank. The recesses 34 in the die block 10 are so spaced that the screw blank will make one complete revolution in passing from one recess to the next. The presence of these recesses causes a blank or unthreaded area to be presented upon the periphery of the screw blank and as the screw blank rotates a half revolution from the first recess 34 of the die block 10, one of the depressions or recesses 34 on the die block 12 will register with that portion of the screw blank which was previously in registration with the first depression on the die block 10. This continues until the unthreaded area on the screw blank is moved into registration with the first insert 24 on the die block 10. This causes an initial impression to be made by the insert upon the blank or unthreaded area of the screw blank. When the blank has completed one rotation beyond the first insert 24, the second insert 24 registers with the impression made by the first insert. This continues until the locking section D' in the screw blank is completed by the engagement therewith of the last insert in the die block 10. I have found it satisfactory to employ a series of three inserts. Of course the number of inserts will depend upon a number of factors such as the nature of the impression or locking section which is to be produced on the screw blank, etc. The last few depressions 34 in the die block 12 register with and serve as clearance areas for the locking sections produced in the screw blank by the inserts 24.

It will be noted that the protuberance or projection 30' formed by the recessed portion 30 of the die section D is positioned intermediate adjacent thread convolutions on the completed screw member or in other words this portion of the locking section D' is out of helical alignment with respect to the normal thread convolutions produced by the ridges or teeth 18 and 20 of the die blocks 10 and 12, respectively. By reason of this offset relationship the projection 30', if harder than the work into which the screw is inserted, will cause axial displacement of a thread convolution in the work (not shown). In fact, the projection 30' is so disposed as to cause longitudinal severance of a complementary crest in the thread convolution of the work as well as a spreading and axial displacement in opposite directions of the severed portions of the work thread. In this way the section D' of the screw serves as a locking section to prevent inadvertent retrograde rotation of the screw.

In Figs. 7 to 13, inclusive, I have shown a modified die insert which is designated generally by the numeral 24*a*. This die insert has a working face or surface E. Particular attention is directed to the fact that the configuration of the working surface E of the insert 24*a* is so arranged that when a screw 22*a* is rolled between die blocks 10*a* and 12*a*, a locking section designated generally by the letter E' is produced in the screw blank 22*a*. It will be noted that the configuration of the working surface E of the insert 24*a* is such as to produce the locking section E' in the screw, which when inserted within a threaded aperture causes adjacent sections of thread convolutions to be axially urged toward each other and thereby set up resistance to rotation. The central portion of the working surface E of the die insert 24*a* presents converging serrations or ridges which approach a common point designated by the letter F. In rolling the screw this point of convergence F produces its counterpart F', which is a point of depression in the locking section E'. These converging serrations of the die insert produce converging areas in the screw blank so that when the screw is inserted within a threaded aperture, complementary top portions of the thread in the work will be forced together at the point F'. In order to rotate the screw 22*a* in either direction after it has been initially applied to the work, it is necessary to force apart previously deflected thread sections of the work. This is accomplished by sections of the screw thread G', which diminish in height as they approach the point F', and likewise complementary thread recesses G in the die insert 24*a* decrease in cross-sectional area as they approach the point F.

From the foregoing it will be apparent that the present invention contemplates an extremely simple and expeditious method for producing screws with locking sections associated with a thread convolution thereof. It is conventional practice to use hardened die blocks so as to insure the formation in the screw blank of the required thread configuration. It is proposed to similarly harden the inserts 24—24*a* or at least the working surfaces thereof. Obviously, the structural arrangement or shape of the insert sections or working surfaces D—E may be varied to produce the particular form of locking

section desired. Also the depth and size of the insert section may be varied in accordance with the requirements of the screw upon which the locking section is to be produced.

The invention contemplates a die mechanism for rolling screw threads in which at least one of the die members is provided with ridges for producing screw threads in the work blank and in which at least one of the die members is provided with means such as the sections D—E. These sections are so disposed with respect to the thread producing ridges that when a work blank is rolled between the die members or blocks, a thread displacing section such as the sections D'—E' is produced in the screw blank which is out of helical alignment with respect to the normal thread convolutions produced by the ridges. It is of particular interest to note also that the arrangement of the die sections D—E is such as to produce a complementary or counterpart locking section in the screw blank which is strongest or of greatest cross-section at the base of the thread in the screw, as distinguished from the top of the thread. Thus, the projection **30'** being of greatest cross-section at the root of the thread convolutions in the screw is obviously stronger in this vicinity. Likewise the portions of the locking sections of the screw which shift a pair of adjacent thread sections of the work toward each other are of greatest cross-section at their bases.

The die section contemplated by the present invention is such as to shift a part of the material of the screw blank which, under normal thread rolling operation, would be used to form a full thread in the screw and so position said shifted portion as to be misaligned with respect to the normal thread helix and thus provide means for axially displacing a thread in the work when the screw element is applied thereto. That is to say, the die mechanism contemplated hereby is provided with means cooperatively arranged with respect to the usual thread forming ridges or teeth and so positioned as to act upon the intermediate portion of the zone of the screw blank between die serrations or teeth. Thus, the depressed or recessed area **30** of the die section D acts upon the intermediate portion of the zone positioned between the serrations designated by the letter A and C in Fig. 3. This results in the counterpart projection **30'** being positioned between adjacent thread convolutions in the resulting screw blank.

I have found it desirable to vary the position of the working face of the die inserts with respect to the plane of the working face of the die block **10** with which said inserts are associated. Thus, the first die insert to engage the screw blank is positioned to make a rather light impression and the succeeding inserts make heavier impressions until the final insert makes the deepest or complete impression in the screw blank. It will also be apparent that while the die insert **24a** as shown in Figs. 9 to 13, inclusive, presents the V-shaped groove or depression G in which the included angle remains constant over the entire extent thereof, the invention contemplates modified configurations wherein this angularity may vary. In other words, as previously pointed out, the invention is not limited to the particular die configurations disclosed in the drawings but is capable of other modifications and changes without departing from the spirit and scope of the appended claims.

I claim:

1. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members and including a work shifting surface disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce in the side surface of a thread convolution a thread shifting surface extending out of helical alignment with respect to the normal thread convolutions produced by said ridges.

2. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section forming only a part of at least one of said die members and including a work shifting surface disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread shifting surface which is so disposed out of helical alignment with respect to the root portion of a normal thread convolution produced by said ridges as to shift the crest of a thread convolution in a female threaded member.

3. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and one of said die members providing a work shifting surface section disposed out of thread forming alignment with a ridge and operable when a screw blank is rolled between said die members to produce on the blank a thread diverting surface protruding from a side surface of a thread convolution between the root and crest of said thread convolution.

4. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members, said section including an indented work shifting surface portion disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread shifting protuberance disposed out of helical alignment with respect to the normal thread convolutions produced by said ridges to axially shift a thread crest of a female threaded member.

5. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members, said section including an extruding portion disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce a thread displacing base on the side surface of a normal thread convolution produced on said blank by said ridges.

6. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members, said section including indenting and extruding portions disposed out of working alignment with the crest and side surface respectively of at least one of said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread displacing surface comprising an indentation in the line of the crest of a thread convolution produced by said ridges and an extrusion on the side surface of said convolution.

7. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members, said section including a work shifting surface having a protuberance forming cavity disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread displacing protuberance out of helical alignment with respect to the normal thread convolutions produced by said ridges.

8. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with at least one of said die members and disposed out of working alignment with said ridges so that when a screw blank is rolled between said die members a section is produced on the blank which is out of helical alignment with respect to the normal thread convolutions produced by said ridges, the die member oppositely disposed from said thread altering section being provided with clearance areas for accommodating the section produced on the blank by said thread altering section.

9. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with one of said die members and including a work shifting surface disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread deforming surface which is out of helical alignment with respect to a normal side surface portion of a thread convolution produced by said ridges and protrudes from the normal root portion of said thread convolution to engage and axially displace the crest of a thread of a female threaded member.

10. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges certain of which are interrupted, and an insert in the interruption of said certain ridges providing a thread altering section including a work shifting surface disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread upsetting surface protruding from the side surface of the thread adjacent its root and out of helical alignment with respect to the normal thread convolutions produced by said ridges.

11. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a plurality of thread altering sections associated with and spaced along at least one of said die members, said sections including work shifting surfaces disposed out of working alignment with said ridges and operable when a screw blank is rolled between said die members to produce on the blank a thread displacing surface which is out of helical alignment with respect to a normal side surface portion of a thread convolution produced by said ridges and protrudes therefrom adjacent the root of said thread convolution.

12. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, the defining work surfaces of each ridge forming a linear crest, and a thread altering section associated with one of said die members and having a protuberance, the defining work surfaces of said protuberance forming a crest of which a portion at least is disposed out of alignment with the crest of any thread producing ridge and operable when a screw blank is rolled between said die members to produce on the blank a thread deforming protuberance, the defining surfaces of which form a non-helical thread root at least a portion of which is out of helical alignment with respect to the normal root of a thread convolution produced by said ridges.

13. Die mechanism for forming screw threads in a screw blank, including a pair of relatively shiftable die members for simultaneously acting upon opposite sides of a screw blank, at least one of said die members having thread producing ridges, and a thread altering section associated with one of said die members and disposed out of working alignment with said ridges so that when a screw blank is rolled between said die members a section is produced on the blank which is out of helical alignment with respect to the normal thread convolutions produced by said ridges, said thread altering section including a wall portion which digresses from the surface configuration of said thread producing ridges so as to produce a complementary wall surface in a screw blank which digresses from the side surface of a normal thread convolution and extends into the area normally occupied by an adjacent thread convolution.

14. Die mechanism for forming screw threads in a screw blank including a pair of relatively shiftable die members for simultaneously acting upon different sides of a screw blank, at least one of said die members having thread producing ridges which are defined by work surfaces so disposed as to produce normal thread convolutions, at least one of said die members having a thread altering surface, said surface having a cavity in alignment with a work shifting side surface of a ridge and operable when a screw

blank is rolled between said die members to produce on the blank a thread displacing surface protruding from the side surface of a thread convolution.

15. Die mechanism for forming screw threads in a screw blank and comprising a die member having thread producing ridges and having a thread altering protuberance, a work shifting side surface of the protuberance extending into the space between the crests of at least a pair of the thread producing ridges and operable when a thread is formed on the blank by the die member to produce a thread displacing surface protruding from a side surface of a thread convolution on the screw blank adjacent the root of the thread convolution.

RICHARD T. HOSKING.