March 3, 1959 L. W. BEDKER 2,875,649

THREAD ROLLING

Filed Dec. 10, 1956

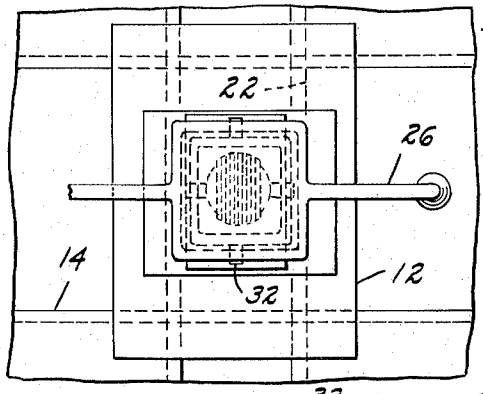


FIG. 1

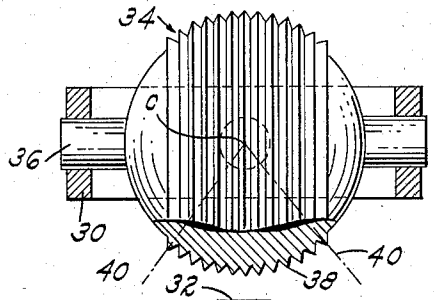


FIG. 4

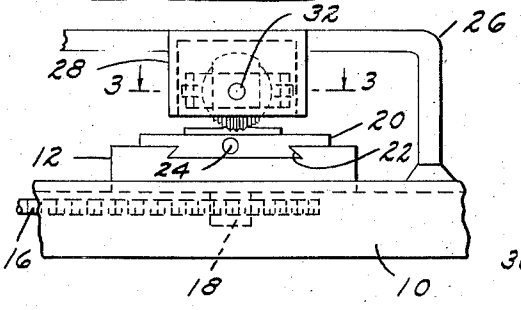


FIG. 2

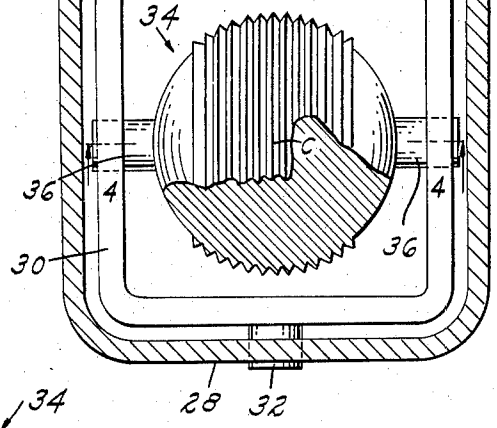


FIG. 3

FIG. 5

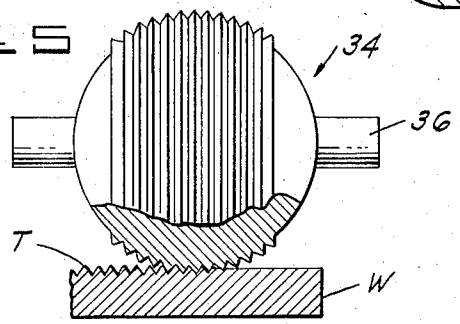
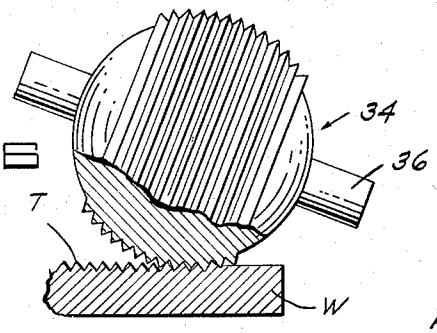


FIG. 6



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THREAD ROLLING

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9 Claims. (Cl. 76—107)

The present invention relates to thread rolling. It is an object of the present invention to provide a thread rolling apparatus, and a method of thread rolling which depend upon a thread roll having a spherical surface provided with a plurality of annular thread-like ribs disposed in planes perpendicular to the axis of said roll.

It is a further object of the present invention to provide thread rolling apparatus comprising a thread roll having a spherical portion concentric with its axis of rotation, annular thread-like ribs formed on said spherical portion and occupying planes perpendicular to the axis of rotation, means mounting the roll for angular movement about a second axis perpendicular to the first axis and means for providing relative reciprocation between a flat work piece and the roll in a direction perpendicular to said first axis and parallel to said second axis, and means for effective relative feeding movement between said roll and said flat work piece in a direction parallel to the plane of the work piece and perpendicular to the direction of relative reciprocation.

It is a further object of the present invention to provide a method of producing threads on a flat work piece which comprises rolling the threads on the work piece with a thread roll of spherical form by moving the roll back and forth across the work piece in parallel, laterally spaced paths.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagrammatic plan view of apparatus for carrying out the present invention;

Figure 2 is an elevational view of the structure shown in Figure 1;

Figure 3 is an enlarged sectional view on the line 3—3, Figure 2;

Figure 4 is a sectional view on the line 4—4, Figure 3;

Figure 5 is an elevational view showing the thread roll engaged with a flat work piece; and

Figure 6 is a view similar to Figure 5, showing the thread roll fed to a different position relative to the work piece.

Described in general terms the present invention depends upon the use of a thread roll having a spherical portion provided with a multiplicity of regularly spaced parallel annular thread-like ribs, cross sections of which are symmetrical laterally with respect to radial lines intersecting the crests of the ribs. The ribs occupy planes perpendicular to the axis of rotation of the roll.

In use the thread roll is rolled back and forth across a flat work piece and after each traverse is moved sideways or laterally to produce a feeding action. The center of the spherical portion of the thread roll is maintained at the proper depth to roll threads to the required depth on the flat work piece.

It will be appreciated that the foregoing provides a rapid and accurate method of producing a thread rolling

plate or die of the type employed in the well-known Waterbury-Farrell thread rolling.

In Figs. 1 and 2 the apparatus comprises a bed **10** having a sub-slide **12** movable horizontally thereon along rectilinearly extending ways indicated at **14**. Suitable means such for example as a feed screw **16** and nut **18** are provided for effecting movement of the sub-slide along the ways **14**.

Mounted on the sub-slide **12** is a work supporting slide **20**, mounted for rectilinear reciprocation on ways **22** provided at the top of the sub-slide **12**. Means including a feed screw, indicated at **24** and associated with a nut (not shown), are provided for effecting traverse of the work supporting slide **20** longitudinally of the ways **22**.

Extending upwardly from the bed of the apparatus is a superstructure **26** including a roll support housing **28**, details of which are best seen in Fig. 3. In this figure, the roll support housing is shown as having a trunnion **30** journaled therein by projecting pins **32**. Rotatably mounted in the trunnion **30** is the thread roll indicated at **34**, having laterally projecting pins **36** journaled in the trunnion to mount the thread roll for rotation therein.

The thread roll **34** in the figures is illustrated as substantially spherical, but in any case it is provided with a spherical portion having its center located on the axis of the pins **36**, this center being indicated at C in the figures. The spherical portion of the thread roll is provided with a multiplicity of annular thread-like ribs **38**. Each of the ribs **38** occupies a plane perpendicular to the axis of the thread roll and the ribs are uniformly spaced circumferentially of the annular portion of the thread roll. Moreover, the ribs are all symmetrically formed with respect to a radial line passing through the crest of each of the ribs, one such line being indicated at **40** in Fig. 4.

From the foregoing description it will, of course, be apparent that the thread roll would be conjugate to a Waterbury-Farrell die and if positioned in contact therewith, with the ribs **38** extending parallel to the threads on the die, the roll could be rolled back and forth longitudinally of the threads on the die and at the same time could be moved transversely. Transverse movement would be accompanied by angular movement about the axis of the pins **32**.

Since the structure so far described accommodates traverse of the roll in interfitting engagement with the teeth of a Waterbury-Farrell die in two different directions occupying a plane parallel to the die, it will, of course, be apparent that the structure may be rolled in any direction on the die. It also follows that if the roll is moved in any direction across a flat work piece under sufficient pressure and at proper spacing, it will roll up conjugate flat ribs or thread-like elements on the flat work piece. These ribs or thread-like elements on the flat work piece can be provided over its entire surface, or any desired portion thereof, by moving the thread roll relative to the work piece in a back and forth pattern arranged to cover the entire surface of the work piece on which threads are desired. Most conveniently this is accomplished by relative traverse along parallel, closely spaced paths, the thread roll being shifted laterally after each stroke of traverse.

Referring now to Figs. 5 and 6, there is shown in Fig. 5 a work piece W on which threads T have been rolled up by the thread roll **34** which has been traversed in a direction perpendicular to the plane of the figure and after each traverse rolled clockwise to the position shown. In Fig. 6 the same parts are shown after a few additional strokes of traverse sufficient to cause the pivot pins **36** of the thread roll to have been angularly moved to the position shown.

It will be appreciated that the shape and dimension of parts has been selected for the purposes of clarity. In a thread roll design for rolling threads on a die of substantial size, sufficient ribs will be provided on the thread roll to produce all of the threads required on the die. However, it will also be understood that the method may be carried out employing a roll having fewer ribs than are required on the die, which will require re-setting the roll relative to the work piece during the rolling operation.

One of the important advantages following the use of the specific thread roll described herein is that the threads on the work piece are produced in a gradual manner. Considering any particular stroke of traverse it will be apparent that the threads on the work piece are finished to full depth only at a line directly under the center of the roll. At the same time contact between the threaded spherical portion of the roll and the work piece extends over a band of substantial width. Thus, as illustrated in Figs. 5 and 6, it will be observed that in addition to the thread groove formed to full depth, some three or four thread grooves in advance thereof are being finished to partial depth. Thus each thread groove is produced in a series of successive passes.

It will, of course, be appreciated that suitable means will be provided for effective relative vertical adjustment between the thread roll 34 and the work piece W so as to cause the crests of the threads on the work piece to enter to the roots of the thread spaces on the roll. In fact, if desired, the roots of the thread spaces on the roll may be provided with relief slots as described in my prior Patent No. 2,699,077, to provide for displacement of the material of the work piece beyond the operating crests of the threads of the finished work piece. However, the operation can be carried out under light pressure between the roll and work, and it is found that metal flows to provide convexly rounded crests on the rolled threads.

The drawings and the foregoing specification constitute a description of the improved thread rolling apparatus in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A thread rolling fixture comprising a roll support mounted for angular movement about a first axis, a roll carried by said support for rotation about a second axis perpendicular to said first axis, said roll having a spherical surface concentric with said second axis provided with thread-like annular ribs occupying planes perpendicular to said second axis and parallel to said first axis.

2. Thread rolling apparatus comprising a work support for mounting a flat work piece, a roll support, means for effecting relative traverse between said work support and said roll support in a plane parallel to the flat work piece carried by said work support, means for effecting relative adjustment between said supports in said plane and in a direction transverse to the direction of relative traverse, said roll support comprising means mounting a roll having a spherical rolling portion for rotation about a first axis intersecting the center of said spherical portion and for angular adjustment about a second axis intersecting the center of said spherical portion, perpendicular to said first axis, and parallel to said flat work piece.

3. Apparatus as defined in claim 2, in which said first axis occupies a plane perpendicular to the direction of relative traverse.

4. Apparatus as defined in claim 3, in which the means for effecting transverse adjustment between said supports is operable at the ends of traverse strokes to provide for a plurality of relative traverse strokes along parallel closely spaced paths.

5. Apparatus as defined in claim 2, in which the spherical portion of said roll is provided with a multiplicity of parallel thread-like annular ribs each of which occupies a plane perpendicular to the axis of rotation of said roll.

6. Apparatus as defined in claim 5, in which said ribs are transversely symmetrical to radial lines passing through their crests.

7. The method of rolling threads on a flat plate with a thread roll having a first axis of rotation and a spherical portion whose center is on said first axis and which is provided with annnular thread-like ribs occupying plane perpendicular to the first axis which comprises relatively traversing said roll and plate in a back and forth pattern parallel to said plate at a constant spacing selected to roll threads on the plate to the required depth, and relatively feeding said roll and plate transversely of the paths of traverse while rocking the roll about a second axis perpendicular to the first axis and parallel to the plane of the plate.

8. The method of rolling threads on a flat plate with a thread roll having a first axis of rotation and a spherical portion whose center is on said first axis and which is provided with annular thread-like ribs occupying plane perpendicular to the first axis which comprises relatively traversing said roll and plate in a back and forth pattern parallel to said plate at a constant spacing selected to roll threads on the plate to the required depth, and relatively feeding said roll and plate at the end of each stroke transversely while rocking the roll about a second axis perpendicular to the first axis and parallel to the plane of the plate.

9. The method as defined in claim 8, in which the rocking and rolling of said roll is controlled solely by its engagement with said plate.

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