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J. H. HOERN

2,259,640

THREAD FORMING APPARATUS

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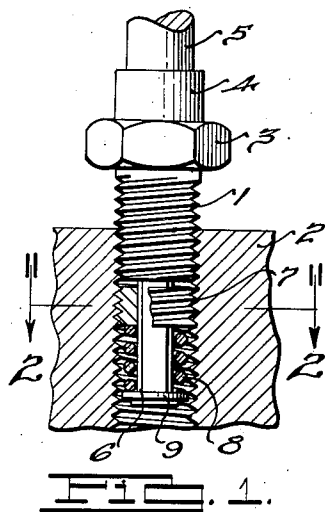
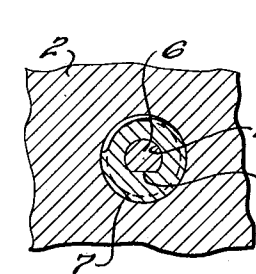
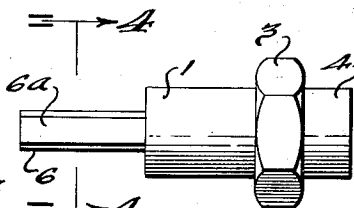


FIG. 2.

FIG. 3.

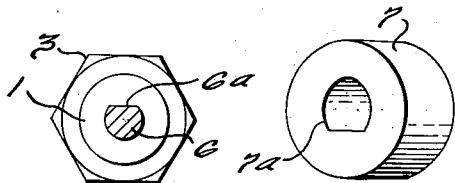


FIG. 4.

FIG. 5.

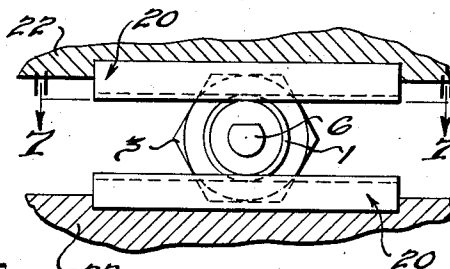


FIG. 6.

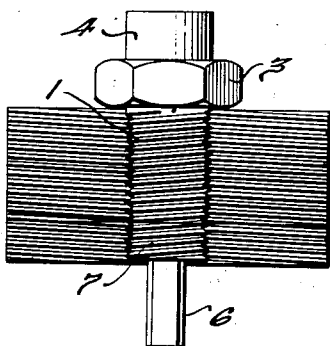


FIG. 7.

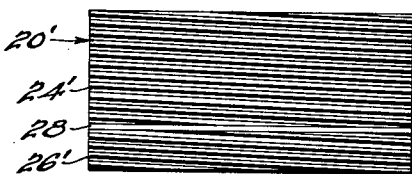


FIG. 8.

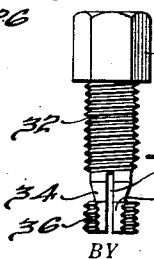


FIG. 9.

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2,259,640

THREAD FORMING APPARATUS

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Application August 18, 1937, Serial No. 159,737

7 Claims. (Cl. 80-9)

This invention relates to thread forming apparatus and particularly to such apparatus as forms threads on articles by a rolling process, and the present application is a continuation in part of my application for Letters Patent of the United States for improvements in Method of making self-locking screws, filed December 23, 1935, Serial No. 55,712.

Objects of the invention are to provide means for forming threads upon an object and in which the threads on one portion of the object are the same size and hand as on another portion of the object, but which threads are mis-matched with respect to the threads on the other portion; to provide apparatus by means of which threads of the same diameter and hand may be simultaneously formed on different portions of an article but by means of which the threads on at least two of said portions will be mis-matched with respect to each other; to provide apparatus by means of which mis-matched threads of the same size and hand may be formed simultaneously on different concentric portions of an article; to provide a thread rolling die structure comprising a plurality of portions arranged in side-by-side relationship, each portion having thread forming grooves and ridges thereon and the thread forming grooves and ridges of one portion being such as to form threads upon an object being simultaneously acted upon by all portions which will not match with the thread formed on the object by another portion; and to provide a thread rolling die including a pair of adjacent portions each having thread forming grooves formed in the surface thereof and the grooves of one portion being so constructed and arranged that the threads formed thereby on an object simultaneously acted upon by both portions will be mis-matched with respect to the threads on the object by the other of said portions.

The above being among the objects of the present invention the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which illustrates suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views;

Figure 1 is a fragmentary, partially broken, partially sectioned view illustrating a self-locking adjusting screw for a valve tappet, the ad-

justing screw being provided with a pair of threaded portions, the threads of one portion of which are mis-matched with respect to the threads of the other portion, this being an illustrative embodiment of one form of apparatus to the manufacture of which the present invention may be adapted.

Fig. 2 is a transverse sectional view taken on the line 2-2 of Fig. 1;

Fig. 3 is a side elevational view of the main body portion of the adjusting screw shown in the preceding figures before being threaded;

Fig. 4 is a transverse sectional view taken on the line 4-4 of Fig. 3;

Fig. 5 is a perspective view of the shiftable threaded element of the adjusting screw shown in Fig. 1 in its blank form;

Fig. 6 is a more or less diagrammatic side elevational view of a pair of thread rolling dies illustrating the adjusting screw shown in Fig. 1 positioned therein and being acted upon thereby to thread different portions thereof;

Fig. 7 is a plan view of the lower thread rolling dies shown in Fig. 6 taken as on the line 7-7 of Fig. 6;

Fig. 8 is a plan view of a thread rolling die member of slightly modified form and construction; and,

Fig. 9 is a side elevational view of a modified form of self-locking adjusting screw, the threads of which may also be formed by apparatus constructed in accordance with the present invention.

While the present invention is applicable for use in producing any object having a pair of concentric threaded portions of the same pitch and hand and in which threads of one portion are mis-matched with respect to the threads of the other portion, one of its uses will be found in connection with the manufacture of self-locking screws, such as screws adaptable for use as adjusting screws in the tappets of internal combustion engines. Accordingly, in order to illustrate the use of the present invention a screw of this type is shown and described in connection with the application of the present invention thereto during its manufacture in order to provide the desired threaded surfaces thereon. The particular self-locking adjusting screw illustrated in Figs. 1 to 7, inclusive, forms the subject-matter of the co-pending application for Letters Patent of the United States for improvements in Valve tappets, filed Sept. 11, 1935 by H. Hald Zeder, Serial No. 40,009 and owned by the assignee of the present invention. The process

of forming such adjusting screw forms the subject-matter of application Serial No. 55,712 above identified of which the present application forms a continuation in part. As will also hereinafter be more fully pointed out the present invention is also applicable for use in the manufacture of adjusting screws of the type shown and described in the United States Letters Patent No. 2,035,055 to Dyer, and to the modified form thereof forming the subject-matter of my co-pending application for Letters Patent of the United States filed April 22, 1937 for Improvements in Self-locking adjusting screw, Serial No. 138,292.

In the construction of the self-locking adjusting screw illustrated in Figs. 1 to 7, inclusive, the screw comprises a cylindrical shank portion 1 threaded into a tappet 2 a portion only of which is shown. The shank portion may be rotated by means of a suitable hexagonal head 3, preferably formed integrally therewith and adapted to be engaged by a wrench or other suitable means, and having thereabove a head portion 4 adapted to contact the base end of a poppet valve push rod or valve stem 5. The shank portion 1 of the screw is provided with an axially extending concentric projection 6 of reduced diameter which has one side thereof flattened as indicated at 6a and as best illustrated in Figs. 2 and 3 in order that the projection 6 will be of non-circular configuration. Mounted on the projection 6 and axially movable therealong is a lock element 7 having a threaded outer periphery and having a central aperture 7a of a configuration adapted to receive the projection 6 of the main body portion 1 and preclude relative rotational movement between the lock element 7 and the main body portion of the screw. A compression coil spring 8, having one end abutting the locking element 7 and the other end abutting a suitable washer 9, disposed around the projecting reduced portion 6 of the screw, constantly urges the lock element towards contacting relation with respect to the adjacent axial face of the shank 1 of the screw. The washer 9 is preferably retained in position by means of swaging or peening over the outer end of the projection 6 of the screw shank. As will be more clearly seen hereinafter, the threads on the shank 1 and on the peripheral surfaces of the lock element 7 are of the same diameter and hand but are mis-matched sufficiently so that when both of these members threadably engage the threaded recess in the tappet 2 in which they are screwed, it will be necessary that some axial displacement of the lock element 7 takes place with respect to the threaded shank portion of the screw in order that the threads on both these members will mate with the threads of the threaded recess in the tappet all portions of which are in matching relation with each other at all times. It will be understood that such axial displacement of the lock element 7 serves to compress the spring 8 and causes a constant compression of the spring, frictionally locking the stud as a whole in predetermined position with respect to the recess in which it is screwed firmly enough to prevent relative rotation thereof under the shocks and vibrations to which it is subjected to in service, yet permitting it to be readily adjusted by means of a wrench.

In manufacturing the adjusting screw thus described the main body portion as shown in Figs. 3 and 4 is first constructed and is identical to the main body portion in the completed screw except that the shank portion 1 thereof is un-

threaded and the projection 6 does not yet have its free end peened over as in the final product. A lock member 7 as shown in Fig. 5 which is identical to the lock member 7 in the completed product except that its outer surface is unthreaded is then slipped upon the projection 6 in which case it is axially slidable upon the projection but is non-rotatable relative thereto because of the non-circular configuration of the projection 6 and the corresponding opening 7a in the locking member 7. The spring 8 is then placed over the end projection 6, followed by the washer 9, the spring 8 is compressed and the end of the projection 6 is then peened over as illustrated in Fig. 1 to maintain the washer 9 against outward displacement thereon. The assembly thus described with the peripheral surfaces of the shank 1 and lock member 7 unthreaded is then operated on by thread rolling dies constructed in accordance with the present invention to form threads on the surface of the shank 1 and lock member 7, it being understood that the threads on these two portions are of the same diameter and hand but that the threads on the lock member 7 are mis-matched with respect to the threads on the shank 1 when the lock member 7 is in axial contact with the shank portion 1.

The thread rolling dies indicated generally in Figs. 6 and 7 at 20 are suitably secured or locked in spaced and opposed relation in suitable relatively reciprocable parts 22 of a conventional thread rolling machine. The screw assembly above described is inserted between the dies 20, the parts 22 are relatively reciprocated and, assuming that the dies 20 are spaced the required distance from one another, the assembly is caused to roll between them so as to simultaneously form threads upon the peripheral surfaces of the shank 1 and lock member 7 as will readily be understood. If the dies 20 were constructed in accordance with conventional practice it will, of course, be recognized that under the above described circumstances the threads on both the shank portion 1 and lock member 7 not only would be of the same diameter but they would combine to form a continuous unbroken thread on both parts and, accordingly, the thread on the shank portion 1 would not be mis-matched with respect to the threads on the lock member 7 as is required in the case of the particular adjusting screw illustrated and described.

In order to obtain this mis-matched effect the dies 20 are formed in the manner shown in Fig. 7 in which it will be noted that each die 20 is made up of two parts, namely a part 24 and a part 26 the surface of each of which is provided with a conventional type of threads or, more correctly alternate straight grooves and ridges which when pressed into the surface of a member being acted upon and such member is caused to roll with respect thereto forms a desired thread on the finished product. In the particular case shown in Fig. 7 it will, of course, be understood that the thread forming ribs and grooves of each of the parts 24 and 26 are of the same size and spacing and are arranged in parallelism to each other, but the grooves and ridges of the parts 26 do not match with the grooves and ridges of the part 24 at the line of junction between the parts. In other words, while the ridges on the part 24 are equally spaced with each other throughout the width of the part 24 and the ridges on the part 26 are equally spaced from each other throughout the width of the part 26 the adjacent ridges of these two parts at the line of junction

between the parts are spaced from each other by an amount different than the spacing in the main body portion of the parts so that when a member is simultaneously rolled by both parts 24 and 26 the threads on the member formed by the part 24 will be mis-matched with respect to the threads formed by the part 26.

In the case shown in Fig. 7 the two parts 24 and 26 of the die 20 are shown in actual contact with each other. Under such circumstances it will be readily recognized that the mis-matching effect of the thread rolling ribs and grooves of each part 24 and 26 may be obtained in a number of different ways. For instance both parts may be formed integrally with one another and machined to the form shown, but it will be found more practical if the parts 24 and 26 are originally constructed integral with each other and then cut apart by a saw or other cutting tool which will cut a slot which is not the same width as the spacing of the thread rolling ridges, or a multiple thereof, and thereafter moving the two parts into contact with each other. On the other hand the two parts 24 and 26 of the die 20 may be made in the manner described with no reference to the width of the slot formed in the cutting operation, or may be formed separately from one another, and then the two adjacent edge surfaces of the two parts thus formed ground or otherwise machined away a sufficient amount to obtain the desired mis-matching relation when the two parts are brought together.

On the other hand the dies may be formed in the manner illustrated in Fig. 8 in which similar parts are indicated by the same numerals except that such numerals bear a prime mark. In other words the die 20' is formed of two parts, namely the parts 24' and 26'. In this case the parts 24' and 26' do not actually contact with each other but have interposed between them a shim or spacer 28 the thickness of which is sufficient to provide the desired mis-matching of the thread rolling ridges and grooves on the two parts 24' and 26' to obtain the desired mis-matching of threads in the final product.

It will, of course, be understood that in forming an article with the dies illustrated in Figs. 7 and 8 the width of the parts 24 or 24' and 26 or 26' will be such as to accommodate the desired length of thread formed by each of these parts on the finished product. For instance in the case shown in forming threads on an adjusting screw such as illustrated in Fig. 1, the width of the part 24 or 24' will approximately correspond to the length of the threaded portion on the shank 1 while the width of the part 26 or 26' will substantially correspond to the length of the lock member 7, and in rolling the thread on the adjusting screw in the manner described the assembly will be inserted between a pair of opposed die assemblies 20 or 20' in such position and in any suitable manner so that the parts 24 or 24' and 26 or 26' will act to form threads on the desired portion of the adjusting screw.

In Fig. 9 a different type of self-locking adjusting screw is shown which may be used for the same purpose as the adjusting screw previously described and the threads on which may be formed by the same type of dies as illustrated in Figs. 6, 7 and 8. The adjusting screw shown in Fig. 9 is similar to one form of adjusting screw disclosed in United States Patent No. 2,035,055 to Dyer previously mentioned and is identical to the adjusting screws described and claimed in my co-pending application for Letters Patent of the

United States for improvements in Self-locking adjusting screw, filed April 22, 1937, Serial No. 138,292. In other words, this screw comprises a head portion 30, a threaded shank portion 32, and a conical extension 34 of reduced diameter terminating in a locking part 36 the exterior surface of which is provided with threads of the same diameter and hand as the threads on the portion 32 except that such threads are mis-matched with respect to the threads on the shank portion 32 in the same manner and for the same purpose as in the adjusting screw previously described. In this case the free end of the shank portion 32 carrying the lock member 36 is slotted as at 38 diametrically of the screw to a point adjacent the end of the shank 32. This forms a lock portion 36 into two halves which are normally maintained in spaced relation with respect to each other by the two arms formed in slotting the conical portion 34. These two portions of the portion 34 serve as spring arms, which maintain the locking part 36 in axially fixed relation with respect to the shank 32 but which permit the two halves of the part 36 to spring inwardly with respect to each other. It will be recognized that the action of the screw shown in Fig. 9 is somewhat different than the action of the screw shown in Fig. 1 although the same ultimate result is obtained. In other words when the adjusting screw shown in Fig. 9 is threaded into a threaded opening the lock portion 36 will thread freely into the opening until the threads on the shank portion 32 begin to engage the threads in the opening. At this time continued rotation of the screw shown in Fig. 9 and the resistance to the shank portion 32 entering the threaded opening will cause the two parts of the lock portion 36 to move toward one another, this having the same effect as permitting an axial displacement of the portion 36 with respect to the shank portion 32 and the two halves of the lock portion 36 will thus approach each other a sufficient amount to permit the threads of the shank portion 32 to enter the threaded opening and to permit the adjusting screw to be threaded downwardly therein to the desired depth. However, the two halves of the lock portion 36 being resiliently urged outwardly in the bore of the threaded opening will exert a frictional resistance to turning of the adjusting screw and thus will serve as a lock against inadvertent turning of the screw. It may be noted that the lock portion 36 is flattened off as at 40 at opposite sides of the slot 38, this being for the purpose of eliminating any interferences of the threads at the margins of the slot during and after assembly of the screw in a threaded opening.

In view of the fact that the shank portion 32 and lock portion 36 of the adjusting screw shown in Fig. 9 are relatively widely spaced from one another axially of the adjusting screw, it will not be necessary that the two halves 24 or 24' and 26 or 26' of the thread rolling dies be arranged in as closely adjacent relationship as illustrated in Figs. 7 and 8, although they may be if so desired.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention the scope of which is commensurate with the appended claims.

What is claimed is:

1. A rolling die for forming a pair of series of mis-matched threads upon an object, comprising, in combination, a pair of die sections each hav-

ing normally matched thread forming means thereon, said sections being arranged with the thread forming means of one in mis-matched relation with the thread forming means of the other.

2. A rolling die for forming a pair of series of mis-matched threads upon an object, comprising, in combination, a pair of die sections each having normally matching threads forming grooves therein, and a spacing shim between said die sections serving to establish a mis-matching relation between the grooves in said sections.

3. A thread rolling die comprising a plurality of parts arranged with a common working surface, the working surface of both of said parts being formed with alternate grooves and ridges for thread rolling purposes and with the grooves and ridges of one of said parts spaced from each other the same as the grooves and ridges of the other of said parts and arranged in parallelism therewith, the grooves and ridges of one of said parts being so arranged with respect to the grooves and ridges of the other of said parts that the threads formed by one of said parts upon an object simultaneously acted upon by both of said parts will be mis-matched with respect to the threads formed on such object by the grooves and ridges of the other of said parts.

4. A thread rolling die for producing a self-

locking screw with axially offset threads comprising a die member having a plurality of groups of inclined thread forming serrations on its working face, the serrations of each group being of equal pitch and form, and the serrations of one group being offset with respect to the serrations of the other group.

5. The method of forming a self-locking screw threaded device, which comprises simultaneously rolling axially offset screw threads on separate axially aligned cylindrical portions thereof.

6. The method of forming a self-locking screw which comprises providing a device having a pair of axially aligned cylindrical portions, and rolling screw threads of the same pitch on said portions, with the lead of the thread on one of said thread portions axially offset from the lead of the thread on the other portion, all of the screw threads on the respective portions being rolled simultaneously.

7. The method of forming a die for rolling axially offset threads on axially aligned cylindrical portions of a self-locking screw, which comprises thread grooving a die blank throughout parallel portions thereof, and then manipulating the die to effect an offset between the thread grooves of the respective portions.

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