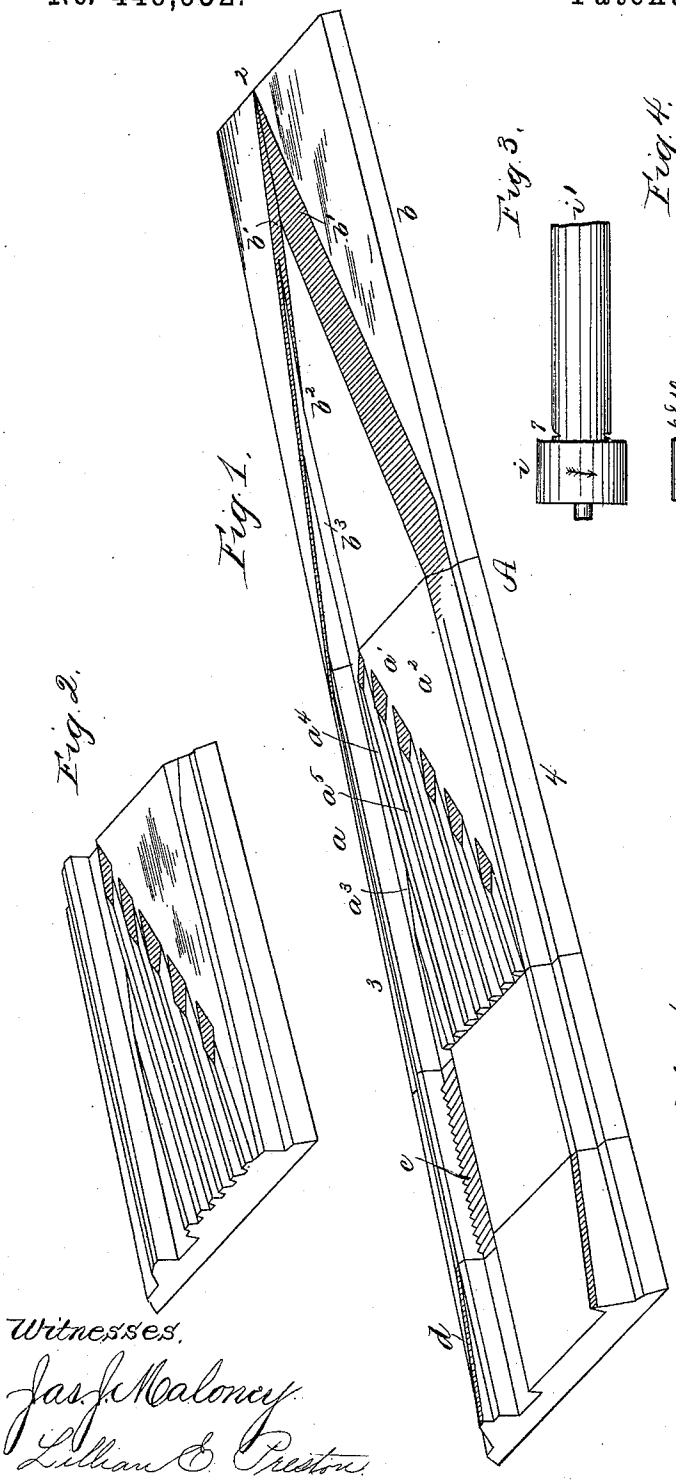
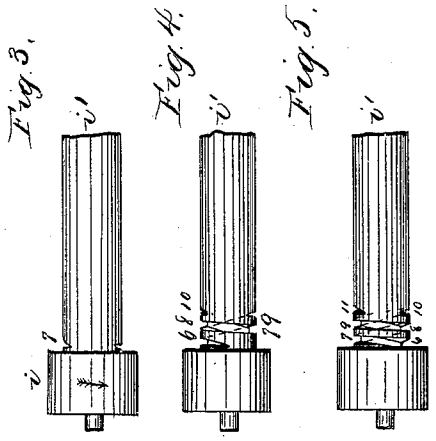
(No Model.)

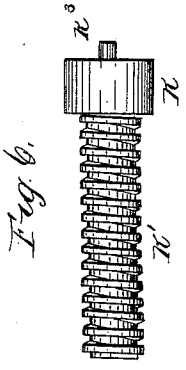
G. F. SIMONDS.

METHOD OF AND APPARATUS FOR MAKING SCREW THREADED ROLLED FORGINGS.

No. 446,932. Patented Feb. 24, 1891.







Witnesses.
Jas. J. Maloney.
Lillian E. Preston.

Inventor.
George F. Simonds.
by Jos. P. Livermore
Att'y.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE F. SIMONDS, OF FITCHBURG, MASSACHUSETTS.

METHOD OF AND APPARATUS FOR MAKING SCREW-THREADED ROLLED FORGINGS.

SPECIFICATION forming part of Letters Patent No. 446,932, dated February 24, 1891.

Application filed August 21, 1890. Serial No. 362,597. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. SIMONDS, of Fitchburg, county of Worcester, State of Massachusetts, have invented an Improvement in Methods of and Apparatus for Making Screw-Threaded Rolled Forgings, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

My invention relates to a method of making a screw-thread and to dies for making a screw-thread by rolling or forging.

Screw-threads have been heretofore made by rolling a blank between dies one or both of which moved and rolled the blank; but in one method of operation heretofore practiced the metal that is displaced to form the thread is raised radially from the blank, so that the diameter of the finished screw at the outside of the thread is greater than the diameter of the blank from which it is made, and the diameter of the bottoms of the threads is smaller than the diameter of the blank, and the blank is not extended or elongated. It has also been proposed to roll a screw-thread by dies that begin to operate at one end of the blank and indent or depress the thread-groove therein continuously to the other end, extending the metal lengthwise of the blank instead of radially, and thus elongating the blank as the thread is formed. In this proposed method the entire work of depressing the thread-groove was performed by a single ridge on the die and the depression of the metal as the blank rotated took place at one side only of the blank, thus causing greater resistance to its rotary movement on one die than on the other, so that there will be a tendency to slip on one die, and thus distort the thread.

My improved method of rolling or forging a screw-thread is like the one just described, in that the thread-groove is depressed and the metal displaced lengthwise of the blank, which is elongated as the thread is made; but it differs from that method in the employment of a series of ridges in the dies, each of which engages in succession with the metal and forms a part of the screw-thread.

The present invention consists in certain improvements in the method of making the thread and in the dies for doing the work.

In the present method the blank is indented at opposite sides simultaneously by ridges on the dies, so that at each half-rotation of the blanks a ridge on each die forms a groove extending half-way around the blank, the said grooves formed by the two dies meeting and constituting a single complete turn of the thread-groove. Different ridges on the pair of dies come into operation successively, each beginning a new turn of the thread-groove in advance of the turns that have previously been formed by the ridges that have already met and acted upon the blank.

The apparatus which I have devised for making screw-threads consists of a pair of oppositely-moving dies, each having a number of ridges extending lengthwise of the die and slightly inclined to its line of movement, the said ridges being arranged side by side across the die, the ridge at one side being the longest and the successive ridges gradually shorter, or beginning at greater and greater distances from the forward or leading end of the die, so that in the movement of the die relative to the blank one ridge arrives at and begins to operate on the blank first and the next adjacent ridge begins to act later, and each succeeding ridge begins to act after the preceding ridge has practically performed its entire work on the blank.

Figure 1 is a perspective view of a die for rolling screw-threads embodying this invention; Fig. 2, a perspective view of a portion of the co-operating die; Figs. 3, 4, and 5, diagram views showing the blank at three successive points in the process of making the thread thereon, the said diagrams each showing the blank as having progressed about one-half a turn from the preceding one; Fig. 6, a side elevation of the finished forging.

The dies *a* for making a screw-thread by forging in accordance with this invention are shown in this instance as parts of the composite dies A, intended to be used in pairs that move in opposite directions with relation to the blank or billet, which is placed between them and rotated by them as they act upon said blank to bring it to the required shape. The forward portion *b* of the composite dies,

or parts that first act upon the blanks, are substantially the same in character as the dies shown in Letters Patent No. 319,754, granted to me June 9, 1885, to which reference may be had. The said dies b consist, essentially, of spreading and reducing surfaces b', that incline upward from the base of the die and diverge from one another from the leading end or portion of the die that first begins to act upon the blank. The said spreading and reducing surfaces b' rise from the base of the die up to the shaping or forming surface b^2, which is in this instance a plane surface, so that the portion b of the composite die acts to reduce a portion of the blank or billet, which is originally of a diameter somewhat larger than the head portion i, Fig. 3, down to the diameter of the part i', Fig. 3, which is equal to the diameter of the threaded portion k' of the finished forging (see Fig. 6) measured outside of the threads. The shaping-surface b^2 of the die b has a groove or depression b^3, in which the head portion i of the said blank shown in Fig. 3 is formed. The original blank or billet is brought by the forward portion b of the composite dies to the shape shown in Fig. 3, and when so formed it may be considered as the blank upon which the threading portion a of the die to which the present invention especially relates is to operate. The base or main portion of the said die a has surfaces $a^2\,a^3$, practically corresponding to the surfaces $b^2\,b^3$, at the adjacent end of the portion b of the die, which surfaces $a^2\,a^3$ thus correspond in shape to the blank $i\,i'$, Fig. 3, and simply serve to guide and assist in the rotation of the said blank without tending to forge it or change its shape.

The effective portion of the die a consists of the leading ends of a series of ridges or projections $a^4\,a^5$, &c., extending lengthwise of the die, but inclined to its path of movement, and the entire series of ridges occupy the entire width of the portion of the die that is to thread the blank. The ridge a^4 at one side of the die extends farthest forward toward the heading end of the die, and the next ridge a^5 begins at a greater distance from the leading end, and the next ridge at a still greater distance, and so on, the leading ends of the ridges thus lying in a diagonal line across the surface a^2 of the die.

When it is necessary to provide for the easy entrance of the ridges into the metal, the leading ends of the different ridges $a^4\,a^5$ are inclined upward from the surface a^2 of the base of the die, and are also inclined to the path of movement of the die, as shown, and when necessary for the purpose of engaging the metal positively and insuring its rotation they are corrugated or roughened, as shown. By this construction and arrangement their effect is like that of the spreading and reducing surfaces b' of the die b, the said leading ends gradually entering into the metal and crowding the surplus or displaced metal lengthwise of the blank, and in this instance crowding it all in one direction from the side 3 toward the side 4 of the die a. The thread is thus formed in the blank by depressing a spiral groove in the blank and extending the blank lengthwise as the metal is displaced, instead of crowding or forcing the metal up to a greater diameter than that of the blank, and thus raising the threads upon the blank.

The work of displacing the metal to form the thread is performed by the leading ends a' of the ridges, and the remaining part of the ridges runs in or meshes with the portion of the thread that has already been formed by the leading ends of the ridges, and the different turns of the thread-groove are begun successively, one complete turn being made by an opposite pair of ridges during each half-rotation of the blank. The metal is operated upon at opposite sides of the blank simultaneously, but only for a small number of turns at once—namely, when the leading ends of the one or more ridges of the upper and under die that meet the blank during a half-rotation thereof operate. For very small threads it is not necessary that the leading ends a' of the thread-forming ridges $a^4\,a^5$ should be beveled or inclined, as shown, although the form is the best for properly controlling the flow or change of shape of the metal, especially when the thread is of considerable size.

The composite die A shown in this instance is adapted to produce a threaded bolt k' with an enlarged knurled head k, as represented in Fig. 6, and a small journal or pivot portion k^3, the said bolt and head being suitable for operating the movable jaw of a monkey-wrench. The head portion k of the forging has its surface knurled by portions c of the composite dies A, the construction and operation of which are more fully disclosed in another application for Letters Patent, and is not herein claimed. The composite dies A are also provided with portions d, by which the ends of the finished forgings are cut off, this portion being substantially the same as described in Letters Patent No. 319,754.

The different parts of the composite die are shown as made in separate pieces adapted to be fastened together in a bed-plate, which may be operated in a machine such as shown and described in Letters Patent No. 319,752, granted to me June 9, 1885; but it is obvious that the entire die might be made of a single piece, and also that the portion a of the composite die forming the subject of this new invention may be used alone and operate on a suitably-shaped blank or billet; but it is in many cases preferable to assemble all the dies required to make a given forging into a single composite die, so that the forging may be completed at a single operation and at a single heat.

The improved method of making screw-threads in accordance with this invention is best illustrated by Figs. 3, 4, and 5, which

also illustrate the operation of the pair of dies a upon the blank $i\ i'$. The portion i' of the blank that is to be threaded is first indented or depressed at the extreme end of the portion to be threaded at opposite sides simultaneously, as represented at 6 and 7. These indentations are then carried by the rotation of the blank spirally around the surface of the blank until the groove begun at 6 reaches the point 7, thus making a continuous spiral groove from 6 to 7, which is the grooved portion on the rear side of the blank represented in dotted lines on Fig. 4. The groove that was begun at 7 has at the same time been carried half-way around the blank to the point 8, as represented at Fig. 4, so that in a half-rotation of the blank i' one complete turn of the thread has been made, this having been done in a pair of dies such as represented in Figs. 1 and 2 by the longest ridges a^4 of the said dies. During or at the end of this half-rotation the second ridge a^5 of the upper die begins to act at 8 and the second ridge of the lower die begins to act at 9, Fig. 4, and in the next half-rotation the said indentations are each carried half around the blank, the lower die making the groove from 9 to 10 (shown in dotted lines at rear of the blank in Fig. 5) and the upper die making the portion from 8 to 9, and after these ridges a^5 have entered the metal the next ridge of the dies begins to act at 10 11, and the operation continues in this way until the desired length of thread has been made. The turn or portion of the thread-groove that is made in one half-turn of the blank is not substantially affected by the die while making the new turns in advance, but merely runs along the ridges of the dies which serve to guide the blank and present the new parts to the action of the dies in the proper position. The thread is thus impressed in the blank progressively from one end to the other, each ridge of each die beginning to act on a new point on the blank in advance of the part already acted upon and grooved by the preceding ridges of the die.

I claim—

1. A pair of oppositely-moving dies for forging screw-threads in metal blanks, the said dies having substantially parallel working-faces, each provided with a number of indenting-ridges inclined to the line of movement of the die, and the ridge at one side being the longest and the successive ridges from that side having their leading ends at greater and greater distances from the forward or leading end of the die, substantially as described.

2. A pair of oppositely-moving dies for forging screw-threads, said dies having substantially parallel working-faces provided with indenting-ridges inclined to the line of movement of the die, and which commence to operate in succession upon the blank to form successive portions of the groove between the threads.

3. Dies for forging screw-threads in metal blanks, the said dies having a number of ridges inclined to the line of movement of the die, the ridge at one side being the longest, and the successive ridges from that side being shorter or beginning at greater and greater distances from the forward or leading end of the die, and the leading ends of the said ridges being inclined to the base of the die, substantially as described.

4. Dies for forging screw-threads in metal blanks, the said dies having a number of ridges inclined to the line of movement of the die, the ridges at one side being the longest, and the successive ridges from said side being shorter or terminating at a greater and greater distance from the forward or leading end of the die, and the leading ends of the said ridges being provided with corrugations, substantially as and for the purpose set forth.

5. The herein-described improvement in the art or method of screw-threading metal forgings, which consists in indenting the blank at opposite sides to the full depth of the thread-groove, rotating the said blank and extending the indentations or grooves spirally around the same until one meets the other, which is at the same time advanced half-way around the blank, and continuing to indent the blank at new points as it rotates and extending the indentations or grooves, substantially as described.

6. The herein-described method of forging screw-threads by rolling a blank between oppositely-moving dies provided with series of indenting-ridges which are forced in succession into the metal to form a groove around a half-circumference of the blank.

7. The method of forging screws and bolts, consisting in reducing the blank to the required shape and size and forming the thread in one operation.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEO. F. SIMONDS.

Witnesses:
JOS. P. LIVERMORE,
JAS. J. MALONEY.