

May 9, 1933.

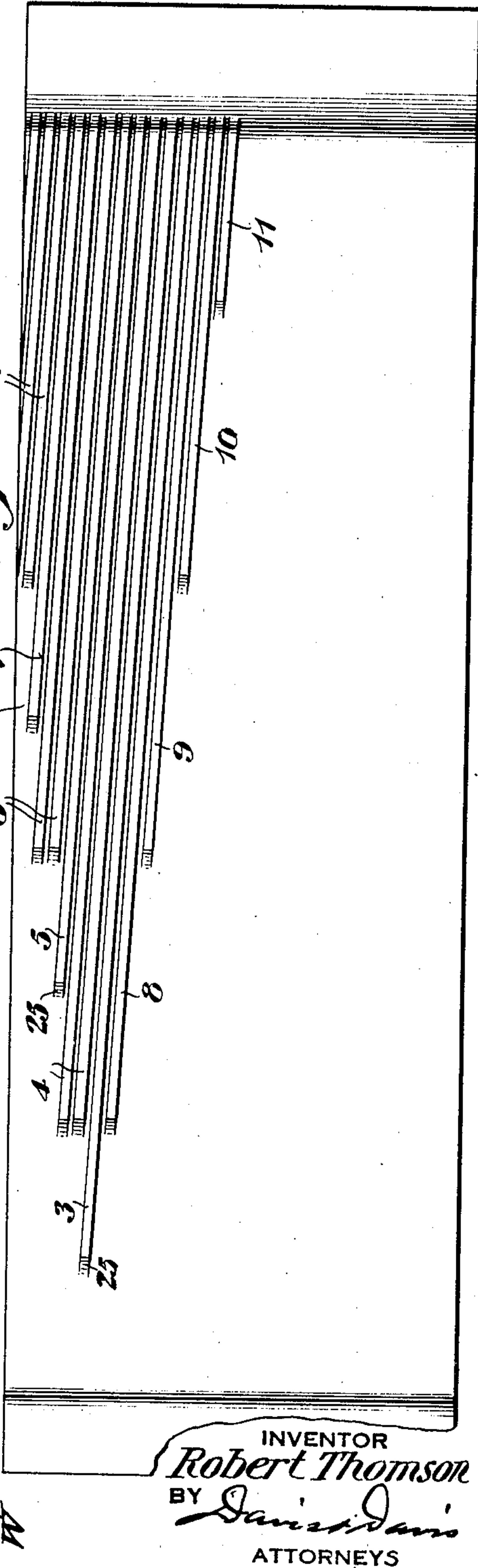
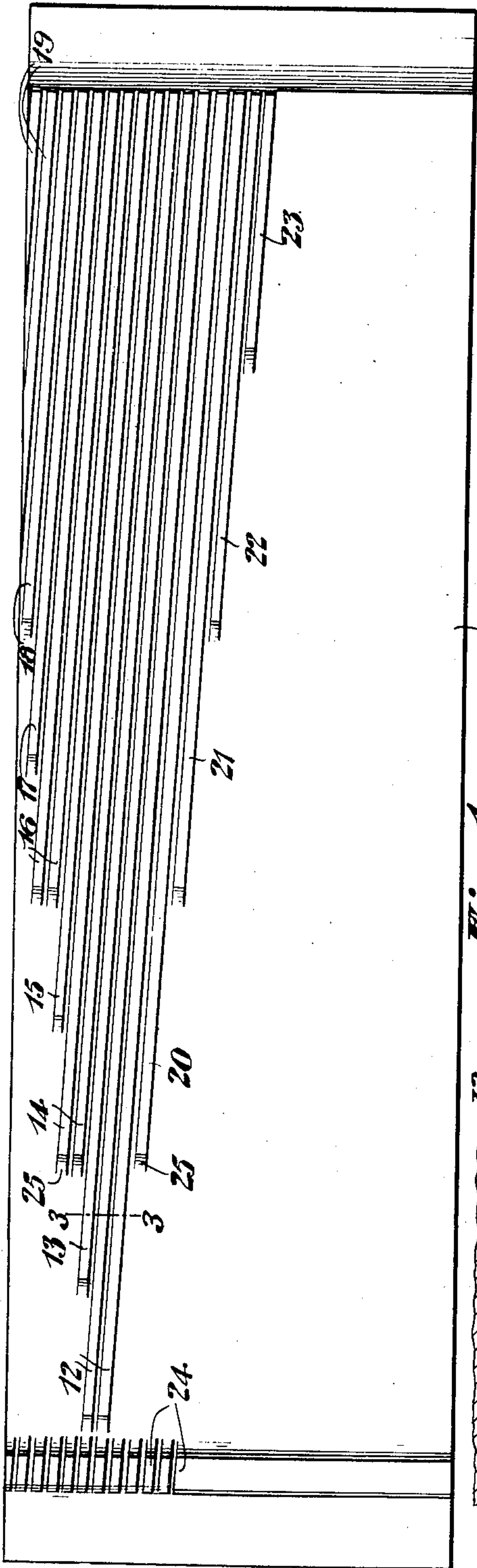
R. THOMSON

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THREAD ROLLING DIE

Filed July 3, 1931

2 Sheets-Sheet 1



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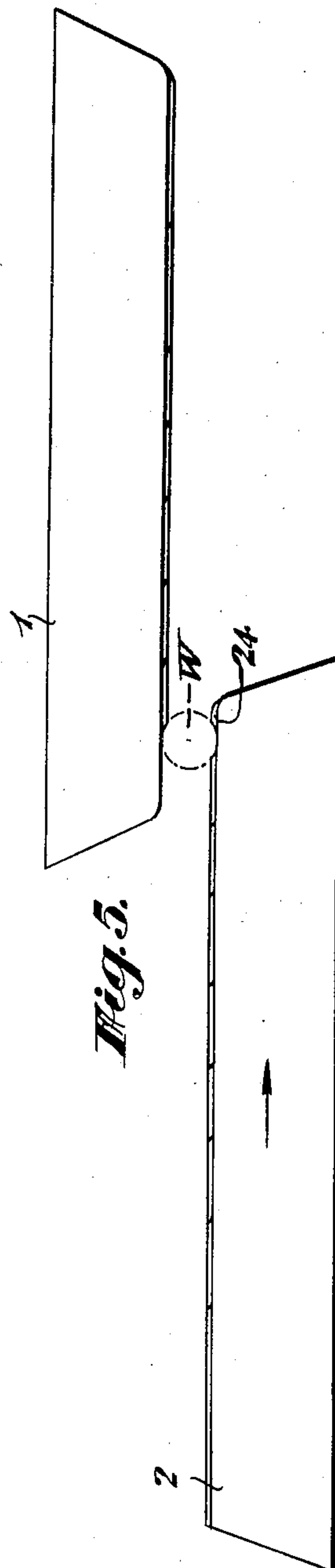
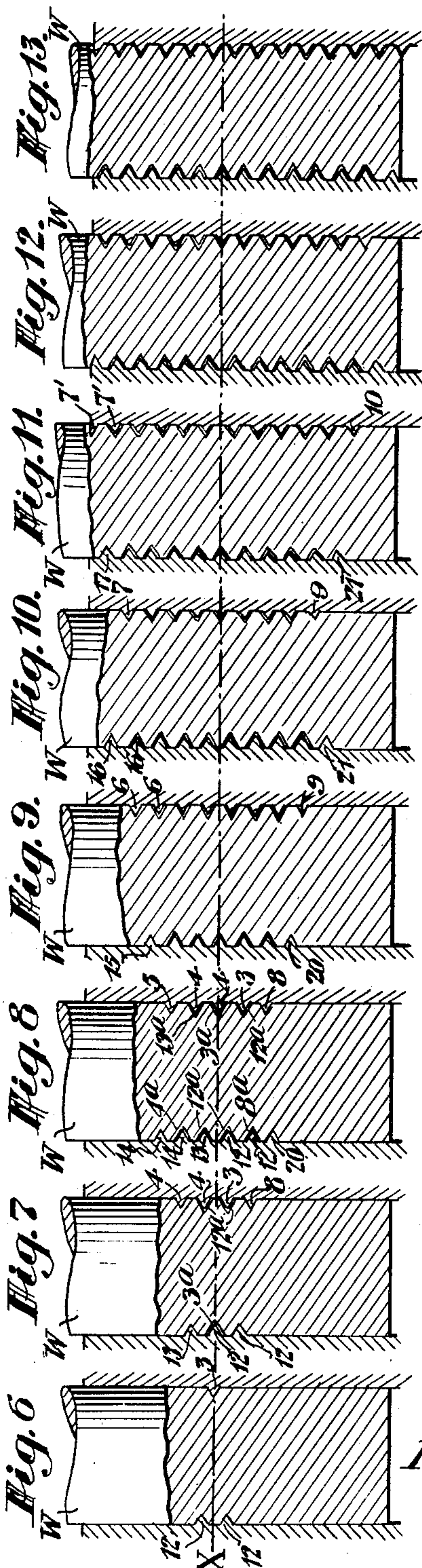
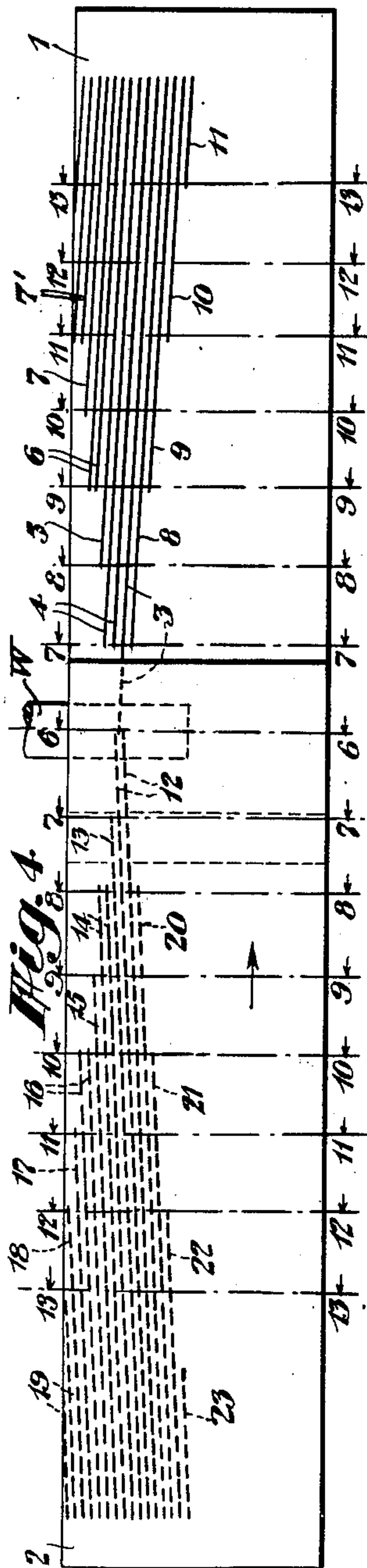
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UNITED STATES PATENT OFFICE

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THREAD ROLLING DIE

Application filed July 3, 1931. Serial No. 548,544.

Important objects of the present invention are, to provide improved thread rolling dies designed for more accurate thread forming; to provide such dies having ribs arranged for successive engagement with the work in a manner to obtain an equalized thread forming action throughout the rolling operation; to provide such dies designed to firmly hold the work in a manner to prevent twisting thereof during the rolling operation and consequent inaccurate thread forming; to provide such dies designed to prevent twisting of the work by an arrangement of the ribs to obtain symmetrical distribution of the points where the thread forming action occurs, so that twisting moments will be prevented; and to provide such dies designed for more equalized distribution of the metal displaced by the rolling operation. Other objects of the invention will appear hereinafter.

In the drawings:

Fig. 1 is a face view of one of the dies;

Fig. 2 a face view of the other die;

Fig. 3 an enlarged detail section taken on the line 3—3 of Fig. 1 showing several of the die ridges in engagement with a work piece;

Fig. 4 a side view of the two dies upon a reduced scale showing them in cooperative relation at the beginning of a thread rolling operation;

Fig. 5 is an upper edge view of the dies in said relation; and

Figs. 6 to 13 inclusive, enlarged transverse sections taken on the correspondingly numbered section lines of Fig. 4 and diagrammatically showing the successive engagements of the thread forming ribs with the work.

The bodies of the dies are flat, rigid plates preferably formed of high speed steel and shaped for mounting in a standard thread rolling machine. The die which is to be mounted in a fixed position in the machine is designated 1 and the reciprocating die is designated 2. Each has a rectangular working face upon which there are thread forming ribs or ridges arranged to form a tapering field. In general outline the field defines a salient directed toward the leading end of the die. The ridges are preferably formed upon the die face by a milling opera-

tion and then the die is hardened. It is customary to operatively mount thread rolling dies in vertical planes with one longitudinal edge uppermost. In the present instance the ridge fields are formed adjacent the upper longitudinal edges of the dies and the working faces are flat and smooth below the fields. The excess depth of the dies is merely to adapt them to their mountings in a machine. The dies are intended primarily for hot rolling but they may be employed for cold rolling also.

The fixed die 1 has its thread forming ridges inclined in accordance with the desired thread helix angle at one side of the work which is to be threaded. As shown, the ridges are varied in length in a certain stepped relation for successive engagement with the work during a rolling operation. There is a single ridge 3 of maximum length near the middle of the field. This ridge extends nearest to the leading end of the die. Above the ridge 3 there are in succession a pair of ridges 4, a single ridge 5, a pair of ridges 6, a single ridge 7 and a pair of ridges 7'. These alternating singles and pairs have their leading ends successively spaced rearward in steps each equal to approximately one half the circumference of the bolt shank or other work piece to be threaded. Below the ridge 3 there are in succession single ridges 8, 9, 10 and 11. The ridge 8 has its leading edge spaced rearward from that of ridge 3 approximately one half the work circumference and the succeeding ribs 9, 10 and 11 have their leading ends spaced rearward in steps each equal to approximately the entire circumference of the work.

The moving die 2 has its thread forming ridges inclined oppositely to those of die 1 when in working position. As shown, its ridges are also varied in length somewhat similarly to those of die 1. There is a pair of ridges 12 of equal and maximum length near the middle of the field. Above the ridges 12 there are in succession a single ridge 13, a pair of ridges 14, a single ridge 15, a pair of ridges 16 and a single ridge 17. These alternating singles and pairs have their leading ends successively spaced rearward in steps

each equal to approximately one half the circumference of the work piece. Outward of the ridge 17 there is also a ridge 18 having its leading edge similarly spaced rearward, and
 5 ridges 19 merging with the upper edge of the die. Below the ridges 12 there are in succession, single ridges 20, 21, 22 and 23 having their leading ends spaced rearward from the ends of ridges 12 in steps each equal to ap-
 10 proximately an entire circumference of the work piece.

In the present instance the thread forming ridges of the two dies have a cross sectional contour designed for forming a well known
 15 Dardelet type of thread disclosed in U. S. Patent No. 1,657,244. The ridges are materially wider than the grooves between them, the crests of the ridges make an angle of preferably six degrees with the die faces and their
 20 side faces converge outward slightly. Such die ridges will form, upon a bolt or similar work piece, a male thread having a groove materially wider than its rib and a sloping root surface adapted for self-locking coac-
 25 tion with a similarly sloping surface upon the crest of an engaged female thread. This self-locking coaction is obtained by relative cross-wise displacement of the engaged threads upon relative turning of the threaded mem-
 30 bers without axial advance. At their leading ends the thread forming ridges are beveled, as at 25.

For the performance of a thread rolling operation a work piece is fed between the over-
 35 lapped end margins of the dies. Here a relieved marginal portion 24 of the die 2 prevents its escape, and the die 2 is moved in the direction of the arrow of Fig. 4 or 5 to bring the stepped ridges into action successively.
 40 In Figs. 6 to 13 inclusive the sequential engagements of the ridges with the work piece are shown diagrammatically. In these views the ridges are shown as of V-form in order to simplify the illustration, and where the
 45 ridges are shown as traveling in grooves or groove convolutions formed earlier in the operation said grooves are represented as larger than the ridges to distinguish them from grooves which are being initially formed by
 50 ridges.

The opposed ridges 3 and 12 of the two dies are so located that at the beginning of the thread rolling operation the leading end of ridge 3 will be disposed directly opposite
 55 the space between the leading end of the ridges 12 diametrically across the work piece W, as shown in Figs. 4 and 6. Thereby the work piece is held by said ridges at three points symmetrically located with reference
 60 to a line X perpendicular to the die faces. This symmetrical ridge engagement with the work piece continues throughout the first half turn of the work piece. At the beginning of the second half turn of the work
 65 piece, as shown in Fig. 7, one of the ridges

12 enters the groove 3^a formed by the ridge 3, the other ridge 12 and the ridge 13 start to form grooves at opposite sides of groove 3^a. Simultaneously, at the opposite side of the work piece the ridge 3 and one of the
 70 ridges 4 enter the grooves 12^a previously formed by the ridges 12, and the other ridge 4 and the ridge 8 start to cut new grooves. It will be seen that the initial thread forming points are again symmetrical with re-
 75 spect to line X and that there are now four of them, axially advanced one half pitch space at opposite sides of the work piece. At the beginning of the third half
 80 turn of the work piece, as shown in Fig. 8, one of the ridges 14, ridge 13, and the ridge 12 enter the previously formed grooves 4^a, 12^a and 8^a and the outermost ridges 14 and 20 start to form new grooves. Simultane-
 85 ously, at the opposite side of the work piece, the two ribs 4 and the rib 3 enter the previously formed grooves 3^a, 13^a and 12^a, and the ridges 5 and 8 start to form new grooves. Thus the work piece is again engaged for
 90 initial thread forming action at four symmetrically located points which are all axially advanced one half pitch space.

At the beginning of the fourth half turn of the work piece, as shown in Fig. 9, the two outermost ridges 15 and 20 at one side
 95 of the work piece and the two outermost ridges 6 and 9 at the opposite side of the work piece start to form new grooves while the intervening ridges enter previously
 100 formed grooves. At the beginning of the fifth half turn of the work piece, as shown in Fig. 10, the outermost ridges 16 and 21 at one side of the work piece and the outermost ridges 7 and 9 at opposite sides of the
 105 work piece begin to form new grooves while the intervening ridges enter previously formed grooves. At the beginning of the sixth half turn of the work piece, as shown in Fig. 11, the outermost ridges 17 and 21
 110 at one side of the work piece and the outermost ridges 7' and 10 at the opposite side thereof start to form new grooves while the intervening ridges at both sides enter previously formed grooves. Thus throughout
 115 the major portion of the rolling operation the thread forming action at both sides of the work piece constantly occurs at points symmetrically located with respect to line X. These points advance equally in oppo-
 120 site directions from said line one half pitch space, or one half the lead of the thread, during each half rotation of the work piece. In the remaining steps of the rolling operation the ridges 10 and 11 of die 1 and the
 125 ridges 22 and 23 of die 2 come into successive engagement with the work, as do also the uppermost ridges of the dies.

The constantly symmetrical thread forming action of the dies causes the work piece
 130 to be held in a manner to prevent the oc-

currence of turning moments which might twist the work piece to oblique positions between the dies and cause inaccurate thread forming. Also, the progression of the thread forming action uniformly outward in opposite directions from a central point causes a more uniform distribution of the displaced metal and ensures the production of a thread of uniform diameter. Accurately formed threads are desirable in order to ensure proper coaction of engaged threads. My improved dies have been designed for forming threads of the desired accuracy.

What I claim is:

1. A pair of cooperative thread rolling dies having thread-forming ribs oppositely inclined in accordance with the desired thread helix angle at opposite sides of the work and having their leading ends varied in spacing from the leading ends of the dies for successive engagement with the work and for progressive initial thread-forming action at diametrically opposite points of the work constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies.

2. A pair of cooperative thread rolling dies having thread-forming ribs oppositely inclined in accordance with the desired thread helix angle at opposite sides of the work and varied in length for successive engagement with the work and for progressive initial thread-forming action at diametrically opposite points of the work constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies and for the advancement of said points outward in opposite directions one half the thread lead at each side of said line and at each side of the work upon each half turn of the work.

3. A pair of cooperative thread rolling dies having thread-forming ribs oppositely inclined in accordance with the desired thread helix angle at opposite sides of the work, the medial ribs of the dies being longest and the ribs at either side thereof decreasing in length in definite steps for successive engagement with the work and for progressive initial thread-forming action at diametrically opposite points of the work constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies and for the advancement of said points outward in opposite directions one half pitch distance at each side of said line and at each side of the work upon each half turn of the work.

4. A pair of cooperative thread rolling dies having thread-forming ribs oppositely inclined in accordance with the desired thread helix angle at opposite sides of the work, the medial ribs of the dies having their leading ends nearest the leading ends of the dies and the ribs at either side thereof having

their leading ends spaced farther from the leading ends of the dies in definite steps for successive engagement with the work and for progressive initial thread-forming action at diametrically opposite points of the work constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies and for the advancement of said points outward in opposite directions one half pitch distance at each side of said line at each side of the work upon each half turn of the work.

5. A pair of cooperative thread rolling dies having thread-forming ribs oppositely inclined in their working positions in accordance with the desired thread helix angle at opposite sides of the work, the medial ribs of the dies being longest, the ribs at one side thereof being successively shorter in outward steps each equal to approximately the work circumference and those at the opposite side of the middle being alternately shorter in outward steps each equal to approximately one half the work circumference for successive engagement of the ribs with the work and for progressive initial thread-forming action at diametrically opposite points thereof constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies and for the advancement of said points one half pitch distance at each side of said line and at each side of the work upon each half turn of the work.

6. A pair of cooperative thread rolling dies having thread forming ribs oppositely inclined in their working positions in accordance with the desired thread helix angle at opposite sides of the work and varied in length and arranged to form rib fields upon the dies tapering toward the leading ends of the dies, one of the dies having a pair of contiguous middle ribs of maximum length, the other die having a single middle rib of maximum length located for engagement with the work at a point opposite the space between the said pair of ribs at the opposite side of the work at the beginning of the rolling operation, ribs at one side of the middle ribs of the dies being successively shorter in outward steps each equal to approximately the work circumference and ribs at the opposite side of the middle being alternately shorter in outward steps each equal to approximately one half the work circumference, for successive engagement of the ribs with the work and for progressive initial thread forming action at diametrically opposite points thereof constantly symmetrical in location with reference to a line through the work perpendicular to the working faces of the dies and for advancement of said points one half pitch distance at each side of said line and at opposite sides of the work, upon each half turn thereof.

7. A pair of cooperative thread rolling dies having thread forming ribs defining a rib field upon each die tapering toward the leading end of the die, the middle ribs of the fields having their leading ends nearest the leading ends of the dies, the ribs at one side of the middle having their leading ends successively farther from the leading ends of the dies in outward steps and the ribs at the opposite side of the middle having their leading ends farther from the leading ends of the dies in alternate succession by outward steps.

8. A pair of cooperative thread rolling dies having thread forming ribs defining a rib field upon each die tapering toward the leading end thereof, the middle ribs of the fields having their leading ends nearest the leading ends of the dies, the ribs at one side of the middle having their leading ends alternately farther from the leading ends of the dies by outward steps each equal to approximately one half the circumference of the work, the ribs of one die at the opposite side of the middle having their leading ends in succession farther from the leading end of the die by outward steps each equal to approximately one circumference of the work and the ribs upon said opposite side of the middle of the other die also having their leading ends farther from the leading end of the die in succession by outward steps, the first step being equal to approximately one half the work circumference and the succeeding steps being equal to approximately one circumference of the work.

9. A pair of cooperative thread rolling dies having thread forming ribs defining a rib field upon each die tapering toward the leading end thereof, one die having a pair of middle ribs starting side by side nearest the leading end of the die, the other die having a single middle rib starting nearest its leading end, the ribs at one side of the middle of both dies alternately starting farther from the leading ends of the dies by outward steps each equal to approximately one half the circumference of the work, the ribs of the die with the pair of middle ribs having the ribs at the opposite side of the middle ones starting in succession farther from the leading end by outward steps each equal to approximately one circumference of the work and the ribs upon said opposite side of the middle of the other die also starting farther from the leading end in succession by outward steps, the first step being equal to approximately one half the work circumference and the succeeding steps being equal to approximately one circumference of the work, and the single middle rib being disposed for location of its leading end diametrically opposite the space between the leading ends of the pair of middle ribs upon the other die at the beginning of a rolling operation.

10. A pair of cooperative thread rolling dies having thread forming ribs defining a rib field upon each die tapering toward the leading end of the die, the middle ribs of the fields having their leading ends nearest the leading ends of the dies and the ribs at the opposite sides of the middle in both fields having their leading ends spaced rearward by successive outward steps from the middle ribs.

In testimony whereof I hereunto affix my signature.

ROBERT THOMSON.