May 13, 1952 W. STERN 2,596,962

THREAD ROLLING MACHINE

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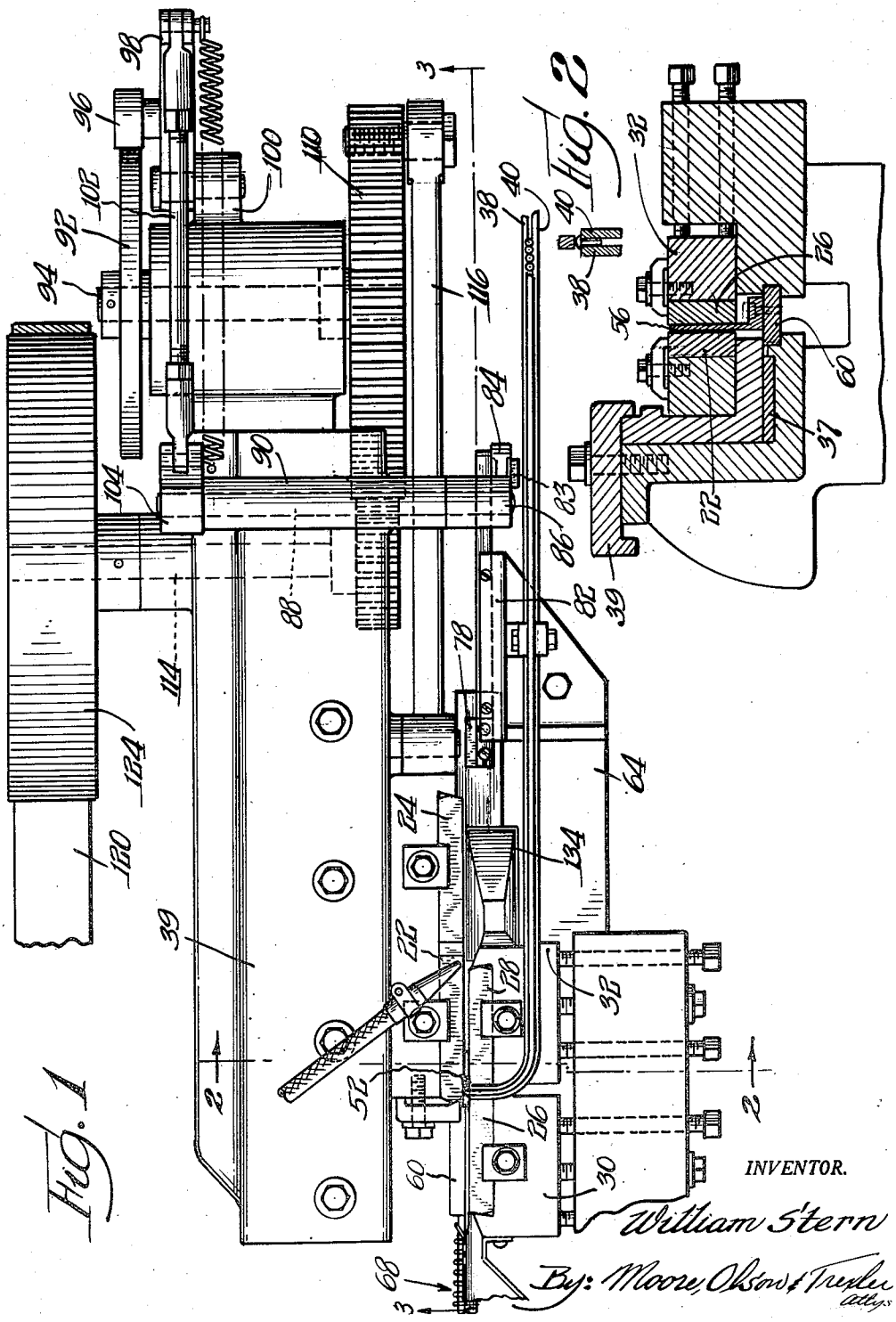


FIG. 1

FIG. 2

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THREAD ROLLING MACHINE

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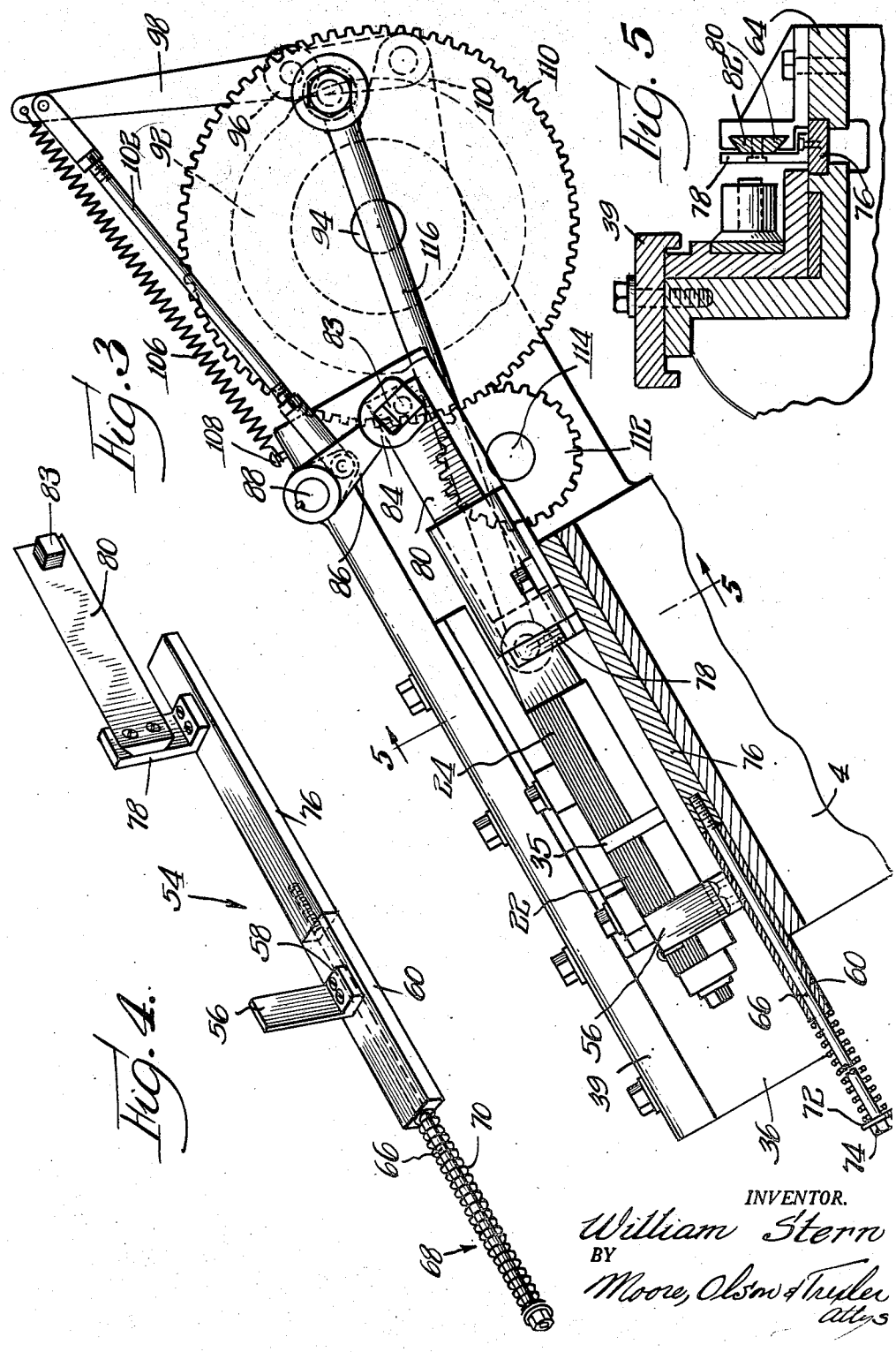


Fig. 3

Fig. 4.

Fig. 5

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THREAD ROLLING MACHINE

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Fig. 6

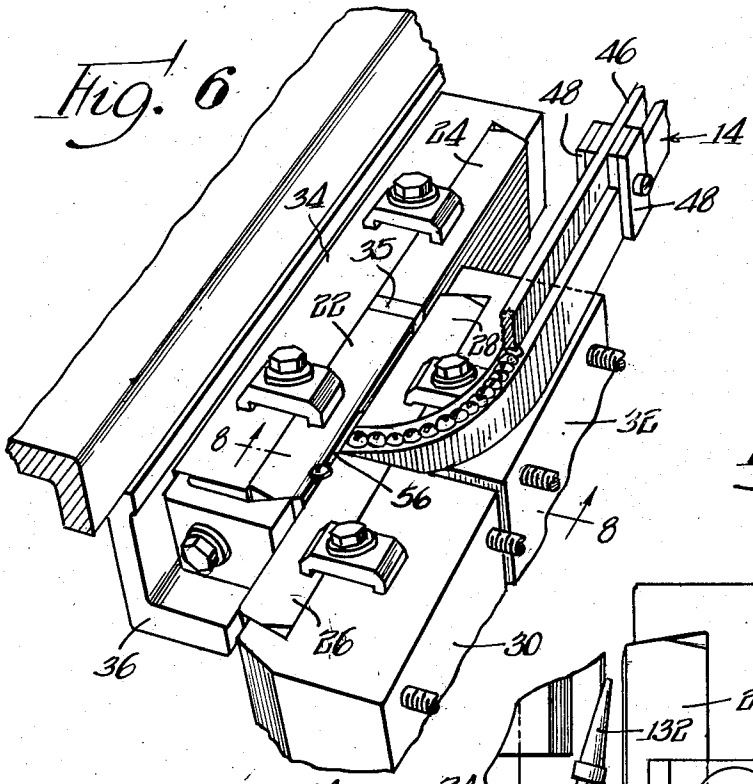


Fig. 7

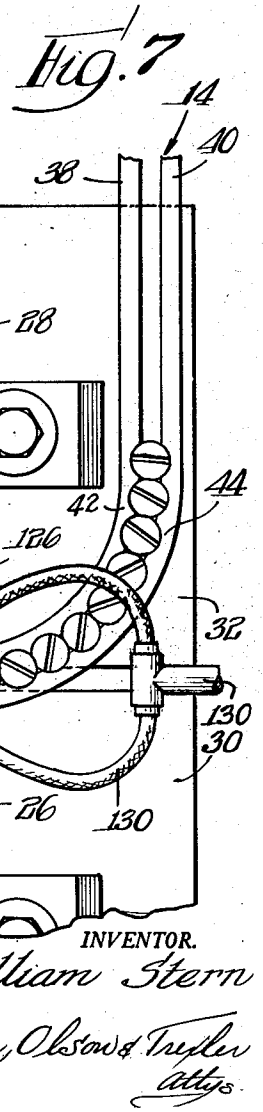
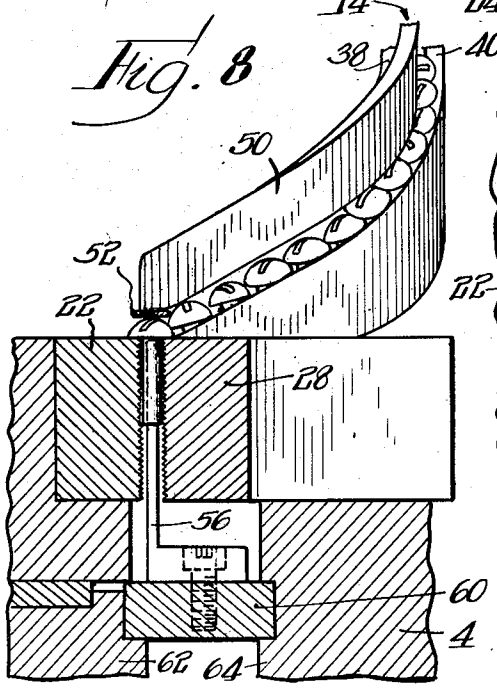


Fig. 8



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THREAD ROLLING MACHINE

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Fig. 9

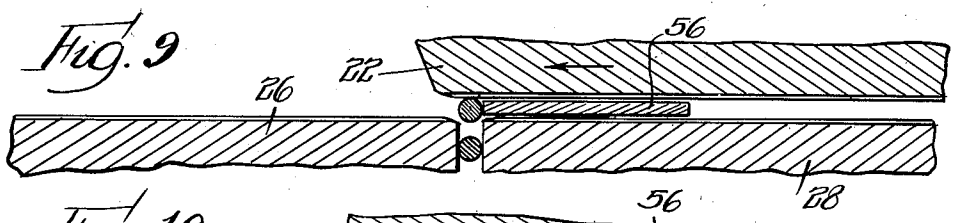


Fig. 10

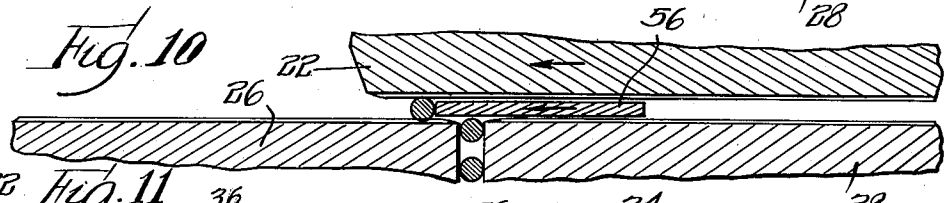


Fig. 11

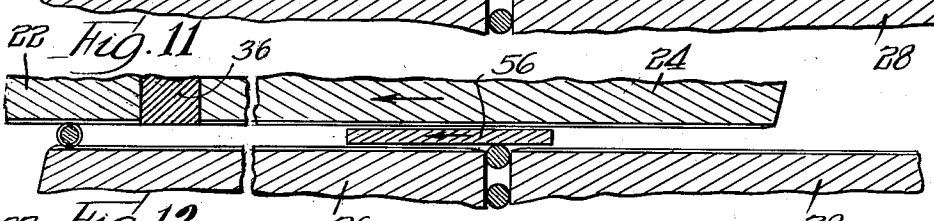


Fig. 12

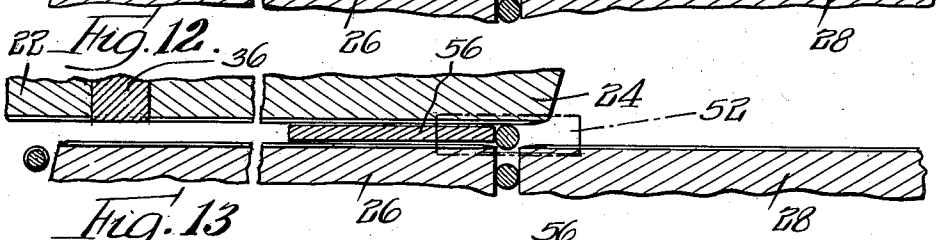


Fig. 13

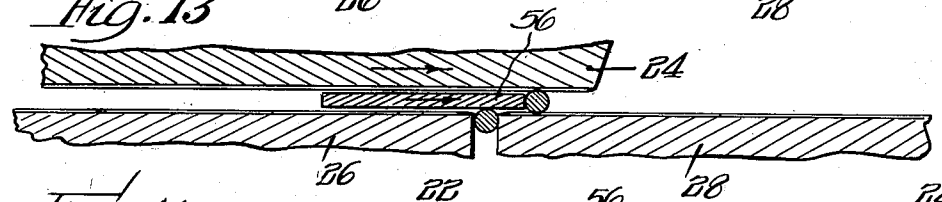


Fig. 14

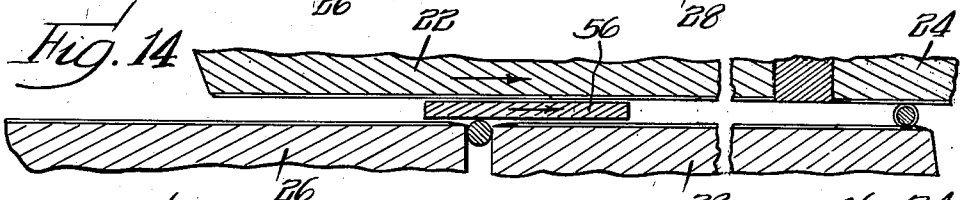


Fig. 15

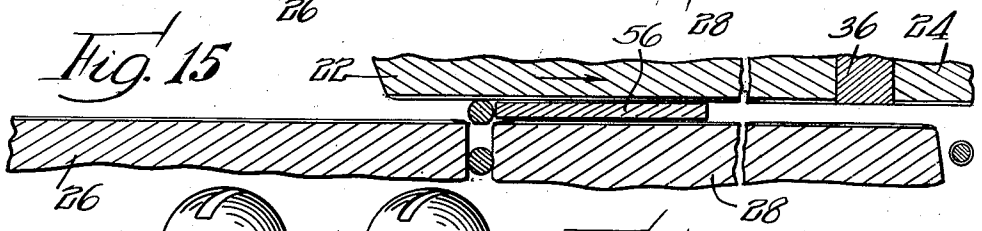


Fig. 16

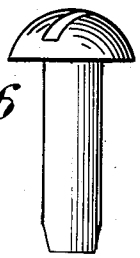
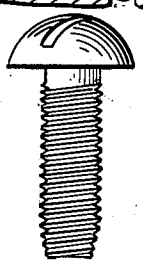


Fig. 17



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UNITED STATES PATENT OFFICE

2,596,962

THREAD ROLLING MACHINE

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Application July 19, 1949, Serial No. 105,493

4 Claims. (Cl. 80—8)

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This invention relates to a thread rolling machine, and more particularly to a machine for rolling threads on the shanks of screw blanks.

It is an object of this invention to multiply the screw working capacity of thread forming or rolling machines or mechanisms.

A more specific object of the invention is to provide, for a single action thread rolling machine, particularly a standard type of inclined screw thread rolling machine, mechanisms by which that machine may be converted into a double acting thread rolling machine, thereby doubling the rate of production or capacity of the machine.

Other objects of the invention are to provide in a reciprocating type thread rolling machine or mechanism multiple, double acting thread rolling dies and screw feeding and starting mechanism precisely timed with respect to the reciprocations of the multiple thread rolling dies to control the feeding of screw elements into the dies to start the screw in one direction into the dies on movement thereof in one direction and to start the movement of the screws into the dies in the opposite direction on opposite movement of the dies; to provide simplified direct feeding means for delivering the screw elements or assembled screw blank and washer units to the multiple dies under the control of the combined starter and feeding mechanism, and to provide novel and improved means for driving the screw starting or screw starting and feeding mechanism to prevent jamming of the machine on improper positioning of the screw element or blank in the thread rolling dies.

Other and further objects and advantages of the invention will appear apparent from the following description when taken in connection with the accompanying drawings wherein:

Fig. 1 is a fragmentary plan view of a machine embodying the present invention;

Fig. 2 is a view in generally vertical section taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a view in vertical section taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a view in perspective of a screw starter and feed control mechanism;

Fig. 5 is a view in generally vertical section taken along the line 5—5 of Fig. 3;

Fig. 6 is a view in perspective illustrating the mounting of the multiple thread rolling dies and the screw feeding means;

Fig. 7 is a fragmentary plan view of the portion of the machine shown in Fig. 6;

Fig. 8 is an enlarged view in generally vertical

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section taken substantially along the line 8—8 of Fig. 6;

Figs. 9 to 15 inclusive are diagrammatic views in generally horizontal section through the multiple thread rolling dies of the starter and feed mechanism illustrating the operation thereof and the timing of the mechanism;

Fig. 16 is a view in elevation of a typical screw blank as delivered to the thread rolling dies; and

Fig. 17 is a view similar to Fig. 16 showing the enlarged thread rolled on the blank of Fig. 16.

As shown in the drawings, a machine which forms one embodiment of the present invention comprises an inclined screw thread rolling machine of standard type, such as shown in Wilcox Patents No. 1,584,263 of May 11, 1926, and No. 1,789,919 of March 31, 1931, to which is attached a plurality of additional and substitute or auxiliary mechanisms by which the rate of production or capacity of the machine may be doubled.

The above mentioned standard type of thread rolling machine comprises a base or body 4, Figs. 3 and 8, inclined at an angle of approximately 30 degrees to the horizontal; a hopper (not shown) for receiving a mass of screw blanks, and a screw blank feed mechanism (not shown) for discharging from the hopper screw blanks which are delivered to a transfer mechanism (not shown) by a continuous inclined chute (not shown). That transfer mechanism, which by this invention applicant has eliminated, is employed in said standard type of thread rolling machine to carry and position the screw between a pair of thread rolling dies into which it is pushed by a starter finger. The continuous screw feeding chute, the transfer mechanism, and the common form of starter finger of the standard machine are replaced by the following described additional substitute or auxiliary mechanisms by which the machine is converted into a thread rolling machine of double the rate of production or capacity.

The additional, substitute or auxiliary mechanisms include a screw feeding chute or means 14. Said mechanisms also include a set of four thread rolling dies 22, 24, 26 and 28, Figs. 1, 3 and 6 to 15, of which the dies 22 and 24 are moving or reciprocating dies and the dies 26 and 28 are stationary dies. The stationary die block 26 is adjustably mounted on and clamped to the standard die mounting block 30 secured and supported in the usual manner on the depending forward end portion of the auxiliary base or body 4, and the stationary die 28 is similarly adjustably mounted on and clamped

to a like die mounting block 32 mounted adjacent the die mounting block 30 in longitudinally spaced relation and similarly supported or secured to the auxiliary base or body 4 upon that portion thereof which in a standard machine forms a shelf or support for the transfer mechanism. The moving or reciprocating dies 22 and 24 are adjustably clamped to a die mounting bar or block 34 in the usual manner, but in end to end longitudinally spaced relation with a spacing block 35 inserted between the die blocks, the mounting block 34 being similar in form to the standard reciprocating die mounting block but having a longer die mounting recess therein to accommodate the twin dies 22 and 24. The die mounting block 34 is carried by and secured to the standard reciprocating bar 36 which is guided in the usual guideway formed by the auxiliary base or body 4, a gib 37 (Fig. 2) and a flange cover plate 39 secured thereto. The twin dies 22 and 24 are alike in every respect and the thread forming ribs or ridges of the dies are inclined in the same direction with respect to the edges of the dies (see Fig. 3). The twin stationary dies 26 and 28 are also alike in every respect, the thread forming ridges or ribs thereof being similarly inclined in the same direction.

The chute 14 comprises a pair of inclined, spaced bars having portions 38 and 40 (Fig. 7) extending substantially parallel to the path of reciprocation of the moving dies, and curved end portions 42 and 44 extending over the adjacent end edges of the stationary dies 26 and 28 and terminating substantially in the plane of the working faces of these dies. The chute bars are spaced apart a distance slightly greater than the diameter of the shanks of the screw elements so as to permit the free passage of the shanks therebetween as the screw elements gravitate down the chute, and at the same time support the heads of the screw elements. The end portions 42 and 44 of the chute bars are so tapered vertically that as the screws gravitate down the chute to the thread rolling dies, the heads of the screws finally rest upon the plane of the upper edges of the dies. The chute bars are so positioned at the lower ends that as the screws move down the tapered end edges of the section of the bars the shanks pass into the space between the die mounting blocks 30 and 32 and are guided and held against tilting movement in a direction lengthwise of the dies by the confronting faces of the die mounting blocks or the ends of the stationary dies.

The chute 14 also includes a cover bar 46 secured as by mounting straps 48 to the chute bars. This cover bar is provided at its lower end with a curved portion 50 concentric to the curved portions 42 and 44 and overlying the heads of the screws as they pass down and along the curved portions 42 and 44. Certain screws, the heads of which are of relatively large diameter compared with the diameter of the shanks of the screws, have a tendency to pile up in head-overlapping positions along the lower end of the portions 42 and 44 of the chute bars. This overlapping may cause the foremost screw element as it passes into the space between the complementary moving and stationary dies to be tilted with respect to the dies so that the head thereof does not lie flush upon the upper edge surfaces of the dies, as shown in Fig. 8. This both interferes with the feeding of the screws down the chute with the proper operation of the starter mechanism as will hereinafter be

described, and with the proper working of the dies upon the shanks of the screw blanks. Accordingly, applicant provides for use with such screws a cover bar 46 which at its lower end is provided with a transverse finger 52 (Figs. 1 and 8) that extends over the space between the complementary moving and stationary dies and extends longitudinally of the dies so as to prevent tilting of the foremost screw blank as it moves into the dies by properly guiding the head of the screw blank.

The starter mechanism 54 (Fig. 4) comprises a finger 56 (Figs. 3, 4 and 6 to 15) in the form of a plate having a base portion 58 bolted to a slide bar 60. As shown best in Fig. 8, the slide bar 60 is guided in ways formed in laterally spaced upstanding portions 62 and 64 of the auxiliary base or body 4 so that the starter finger or plate 56 projecting upwardly from the slide bar extends between the complementary moving and stationary dies and moves parallel to the moving dies as the moving dies and slide bar 60 are reciprocated. The slide bar 60 is also slidably mounted upon an elongated rod 66 of an automatically releasable guide means or connection 68 including in addition to the rod 66 a coil spring 70 encircling rod 66 and interposed between the forward end of the slide bar 60 and a washer 72 held on the rod by a nut 74. The rod 66 at its inner end is threaded into the forward end of a reciprocating driving, or slide, bar 76 guided in the same ways as the bar 60 and serving to drive the slide 60 in a forward direction by abutting engagement with the slide bar 60 and in the opposite or reverse direction through the rod 66 and the spring 70. The bar 76 is provided adjacent its rear end with an upstanding bracket 78 secured to the forward end of a vertical slide bar 80 guided in vertical ways formed in a bracket 82 secured to the upstanding portion 64 of the auxiliary base or body 4 to the rear of the die mounting block 32. A driving block 83 is pivoted to the rear end of the vertical slide 80 and it is received in a bifurcated block or yoke 84 of a drive lever 86 keyed to a drive shaft 88.

The rock shaft 88 is journaled in a boss 90 formed in the cover plate 39. The rock shaft is driven in a counter-clockwise direction, as seen in Fig. 3, by a starter slide drive cam 92 fastened to a drive shaft 94, cam 92 being engaged by a cam roller 96 mounted between the ends of a lever 98 pivoted at its lower end on a fixed bracket 100. The lever 98 drives the shaft 88 in a counterclockwise direction through a link or bar 102 (Figs. 2 and 3) and a crank 104 on the shaft 88. On such counter-clockwise rotation of shaft 88 the starter slide 80 is retracted. The starter slide is advanced or moved forwardly by the action of a coil spring 106 secured at one end to the upper end of the lever 98 and at the other end to a fixed pin 108 in the cover plate 39, the cam 92 determining the distance of advance movement of the starter slide.

The shaft 94 is one of the usual drive shafts of the standard type thread rolling machine and the starter slide drive cam 92 replaces the standard starter slide cam which in the standard machine holds the starter finger at rest in its rearward position during most of the cycle of reciprocation of the movable thread rolling die and advances it during the initial forward movement of the movable thread rolling die and then

returns to its normal rear position while the thread rolling die is still moving forwardly.

On the shaft 94 is also mounted the usual drive gear 110 which is driven by gear 112 on the main drive shaft 114, the gear 110 having pinned to its face a pitman 116 pivoted to the rear end of, and reciprocating the slide 36 which carries the movable dies. The main drive shaft 114 is driven in the usual manner by an electric motor (not shown) through a belt 120, Fig. 1, passing about a pulley 122 on the motor shaft and a pulley 124 on the shaft 114.

Means are provided for assisting the injection of each screw element, or each screw and washer assembly unit, into the thread rolling dies. This means comprises a pair of air nozzles 126 and 128, Fig. 7, coupled to a common air pressure hose 130, the air nozzles 126 and 128 being mounted in any suitable manner to overlie the lower end of the chute portions 42 and 44 and to direct air pressure against the leading screws as they reach the lower end of the chute. As each screw element reaches the end of the chute, as seen in Fig. 8, and approaches the dies, it passes from a sharply inclined feeding plane to the plane of the upper edges of the dies, as seen in said figure, and therefore the gravitational forces feeding the screws into the dies are so reduced that, at least with certain sizes and configurations of screws, there is a tendency for the screws to stick at the bottom of the chute and not be fed into the dies. The frictional resistance to feeding of the screws caused by overlapping of the heads of certain sizes and types of screws also tends to cause the screws to stick at the bottom of the chute and therefore fail to enter the dies. The air pressure directed by the nozzles 126 and 128 against the leading one, or two, or several of the screws at the bottom of the chute serves to inject the foremost screw in position in advance or behind the starter finger when the end of the chute is uncovered by the finger.

The operation of the starter finger, which is also used as a gate to control the feeding of the screws directly from the feeding chute 10, is best shown in Figs. 9 to 15. For purposes of explaining this operation, let us assume that the starter finger has been moved to its rearmost position, as seen in Fig. 9, by the engagement of the cam roller 96 with the high point of the cam 92, and the movable dies 22 and 24 have started to advance forwardly, as indicated in said figure. As the forward edge of the thread rolling die 22 approaches the rear end of the stationary thread rolling die 26, the starter finger 56 is caused to move forwardly under the action of spring 106 as the cam roller 96 traverses the reducing radius portion of the cam 92, this movement of the movable die 22 and the starter finger being illustrated in Fig. 10. The starter finger moves forwardly just sufficient to assure the injection of the shank of the screw between the die 22 and the die 26 so that the continued forward movement of the die 22 causes rolling of the thread on the shank of the screw and the screw in that rolling process forwardly traverses or rolls along the stationary die 26. The starter finger then remains at rest (roller 96 engaging a constant radius portion of cam 92) and is positioned to close the lower end of the screw chute until the movable thread rolling die approaches its forward limit of movement. At that time the starter finger again moves forwardly, as indicated in Fig. 11, as the roller 96 moves into a notch in the cam 92, to uncover the lower end of the chute by the time the movable thread rolling dies have completed their forward movement, as illustrated in Fig. 12. The forward movement of the thread rolling dies is then completed and the thread rolling dies immediately begin their rearward movement. The starter finger now moves rearwardly, as illustrated in Fig. 13, along with the movable thread rolling dies, as the roller 96 moves out of the notch in the cam 92, to insure the injection of the screw shank between the rearwardly moving thread rolling die 24 and the rear stationary thread rolling die 28. The starter finger moves rearwardly sufficiently to again close the lower end of the screw chute, as indicated in Fig. 14, and then remains at rest during the continued rearward movement of the thread rolling dies as the roller 96 engages a constant radius portion of the cam 92 and until the movable dies approach their rearward limit of movement. At this time the starter finger again moves rearwardly, as illustrated by the arrow in Fig. 14, to uncover the chute and allow the next screw element at the lower end of the chute to pass into position in advance of the starter finger, as illustrated in Fig. 15, at the moment that the movable thread rolling dies have completed their rearward movement.

It should be noted that if forward movement of the starter finger 56 is prevented by reason of a mispositioned or tilted screw, i. e., one which has not completely cleared the screw chute but has a part lying in front of the starter finger, no harm will result because this forward movement of the starter finger is caused only by the spring 106. Therefore if the forward movement of the starter finger is prevented, cam roller 96 will simply not follow the surface of the starter slide control cam 92 but will remain out of engagement with the cam. It should further be noted that if the starter finger is jammed against rearward movement, as by a mispositioned screw, part of which lies in the path of the starter finger and part still remains in the screw feeding chute, the slide bar 76 will move rearwardly with it along with the rod 66 attached thereto and thereby contract the spring 70, the starter finger 56 remaining stationary and the rod 66 sliding through.

Means is provided for assisting the discharge of the rolled screw, or the finished screw and washer assembly, from the movable thread rolling die 24 and the stationary die 28. Since the dies are inclined and reciprocate relatively in an inclined plane, on the rearward movement of the movable dies, the screws are carried uphill. The momentum imparted to the screws by the reciprocation and rolling action of the dies cause the screw to be impelled from the stationary die 28 as it reaches the upper end thereof, but in some instances the screw may drop back after having lost momentum and fall between the dies 24 and 26. The discharge means, preventing this falling back of the finished screw or finished screw and washer assembly, comprises an air nozzle 132, Figs. 1 and 7, coupled to a suitable source of air under pressure, which may be the same source as that which supplies the tube 130. This nozzle is so positioned at or adjacent the upper end of the stationary die 28 and is so oriented that the pressure of the air escaping therefrom imparts sufficient momentum to the finished screw or finished screw and washer assembly after it has lost the momentum

imparted to it by the action of the dies as to cause the screw or screw and washer assembly to drop into a discharge chute 134, Fig. 1, by which the screw is directed into a receiving pan 136.

It will be apparent from the foregoing description that applicant has provided devices to multiply the screw working capacity of thread forming or rolling machines or mechanisms, in a single action thread rolling machine, particularly a standard type of inclined screw thread rolling machine, mechanisms by which that machine may be converted into a double acting thread rolling machine, thereby doubling the rate of production or capacity of the machine; in a reciprocating type thread rolling machine or mechanism multiple, double acting thread rolling dies and screw feeding and starting mechanism precisely timed with respect to the reciprocations of the multiple thread rolling dies to control the feeding of screw elements into the dies to start the screw in one direction into the dies on movement thereof in one direction and to start the movement of the screws into the dies in the opposite direction on opposite movement of the dies; a simplified direct feeding means for delivering the screw elements to the multiple dies under the control of the combined starter and feeding mechanism, and a novel and improved means for driving the screw starting or screw starting and feeding mechanism to prevent jamming of the machine on improper feeding or initial feeding of the screw element or blank into the thread rolling dies.

It will be obvious that changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention or sacrificing any of its advantages, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. A screw blank working apparatus including a stationary die having an elongated working surface provided with longitudinal groove forming ribs extending entirely along said working surface except for the blank feed opening medially thereof substantially the width of a blank, a movable die having longitudinal groove forming ribs and movable along said working surface, back and forth, from one side of said feed opening to the other side thereof, the trailing end thereof passing said medial opening at each movement thereof whereby a blank is thereby grooved at each side of said medial opening, an elongated straight line reciprocating feeder and means for reciprocating the same, said feeder being of a width less than the rib spacing of said dies, and the length of said feeder and the said means being so constructed that one end of said feeder passes said opening in pushing a blank to a groove rolling position between said stationary die and advancing movable die while the other end of said feeder holds the remaining blanks in said feed opening until further movement clears said opening for the feed of a second blank into the path of said other end of said feeder, whereupon reverse movement of said feeder pushes said second blank to groove rolling position at the other side of said medial opening for continued operation in a similar manner.

2. A screw blank working apparatus as claimed in claim 1, having means including air blast mechanism for continuously urging screw blanks against the holding surface of the feeder to assure positive feeding of the blanks into the path of movement of the pusher surfaces.

3. A screw blank working apparatus as claimed in claim 1, wherein the actuating mechanism for the feeder is positioned below the die units.

4. A screw blank working apparatus including a stationary die having an elongated working surface provided with groove forming ribs extending entirely along said working surface except for the blank feed opening medially thereof substantially the width of a blank, a movable die having groove forming ribs and movable along said working surface, back and forth, from one side of said feed opening to the other side thereof, the trailing end thereof passing said medial opening at each movement thereof whereby a blank is thereby grooved at each side of said medial opening, an elongated straight line reciprocating feeder and means for reciprocating the same, said feeder being of a width less than the rib spacing of said dies, and the length of said feeder and the said means being so constructed that one end of said feeder passes said opening in pushing a blank to a groove rolling position between said stationary die and advancing movable die while the other end of said feeder holds the remaining blanks in said feed opening until further movement clears said opening for the feed of a second blank into the path of said other end of said feeder, whereupon reverse movement of said feeder pushes said second blank to groove rolling position at the other side of said medial opening for continued operation in a similar manner.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,584,264	Wilcox	May 11, 1926
1,696,225	Blood	Dec. 25, 1928
1,783,796	Kinney	Dec. 2, 1930
2,343,798	Poupitch	Mar. 7, 1944
2,509,056	Gartner	May 23, 1950