

Nov. 12, 1935.

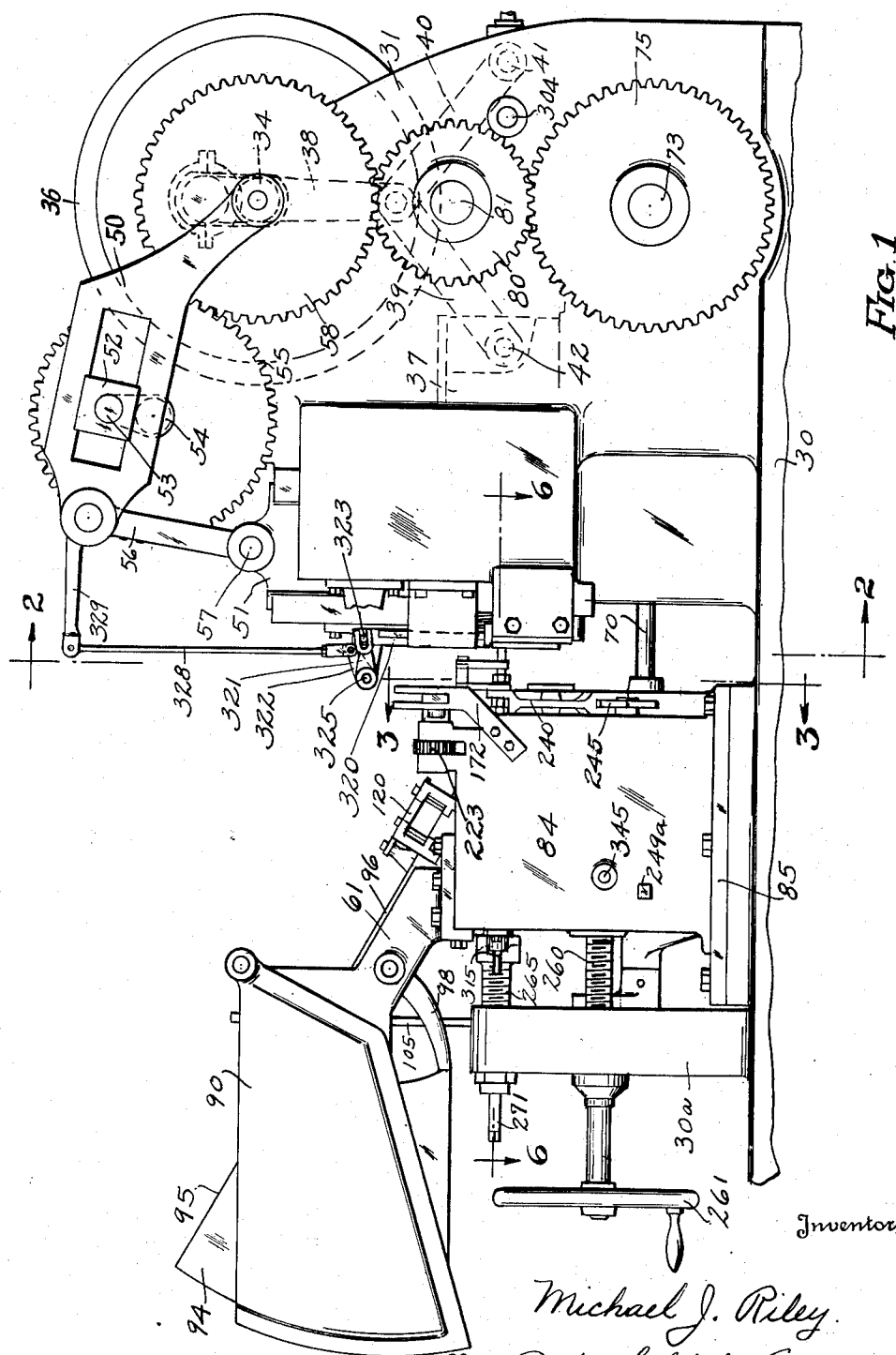
M. J. RILEY

2,020,657

BOLT MACHINE

Filed June 4, 1932

10 Sheets-Sheet 1



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BOLT MACHINE

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10 Sheets-Sheet 2

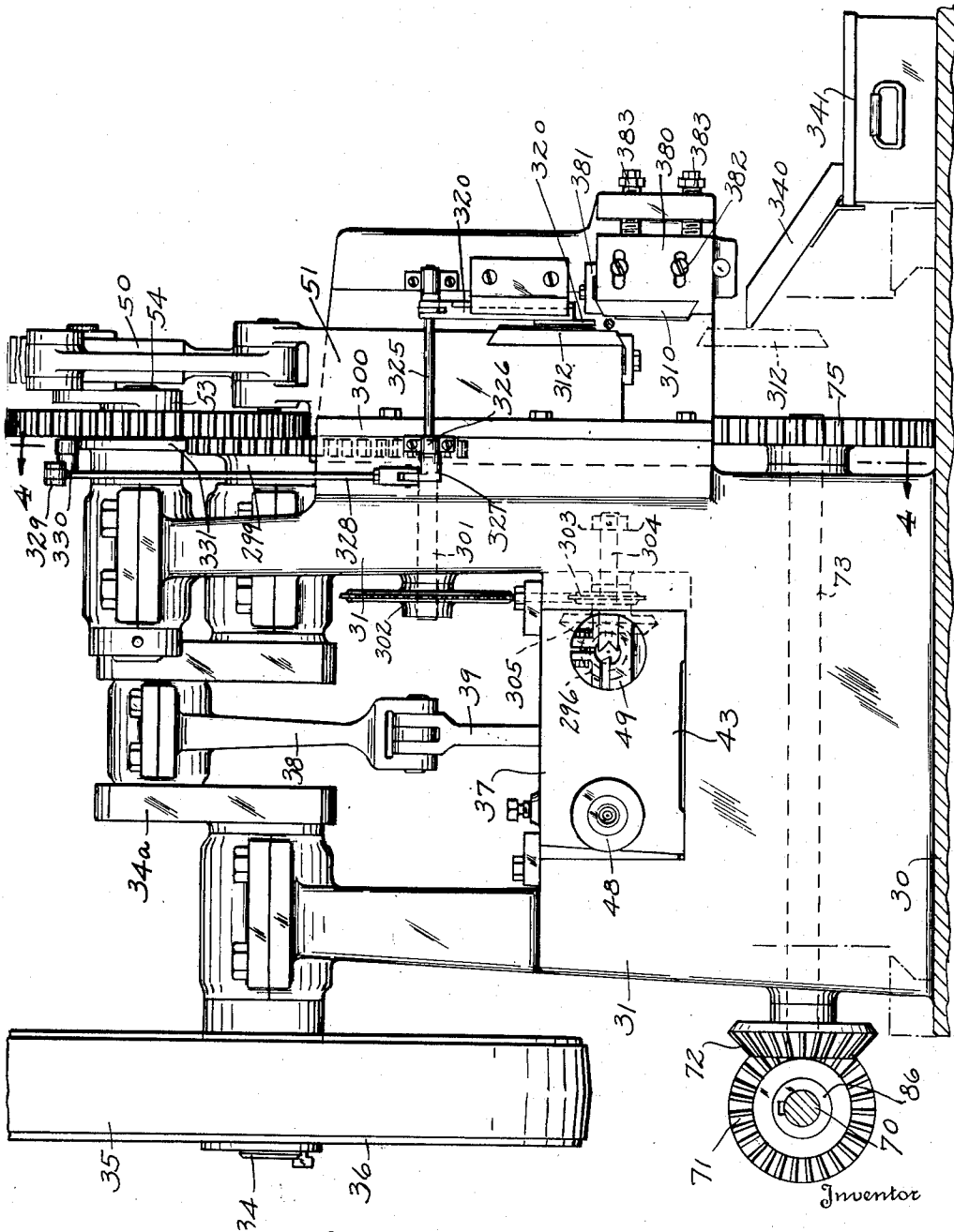


Fig. 2

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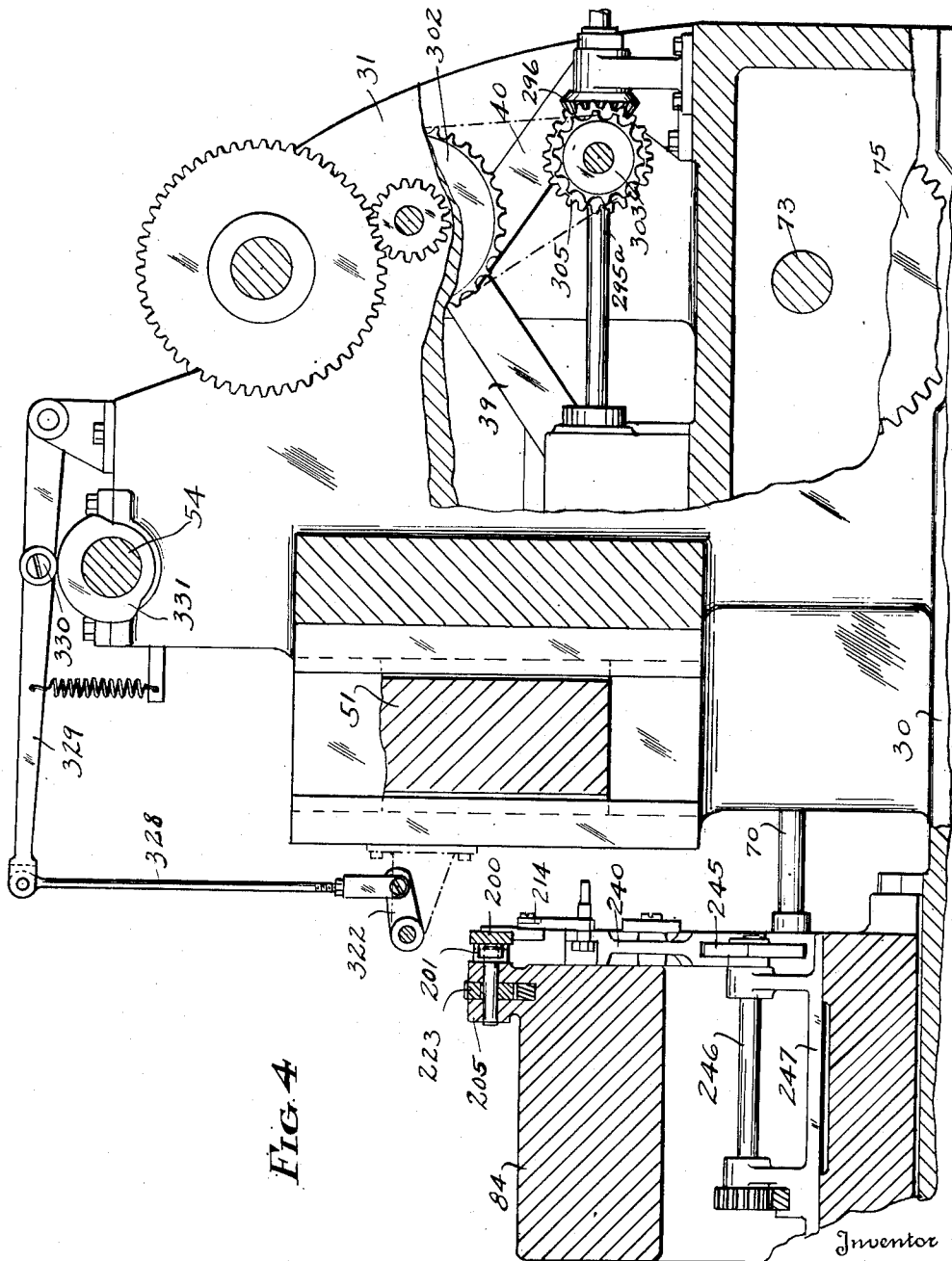
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10 Sheets-Sheet 4



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10 Sheets-Sheet 5

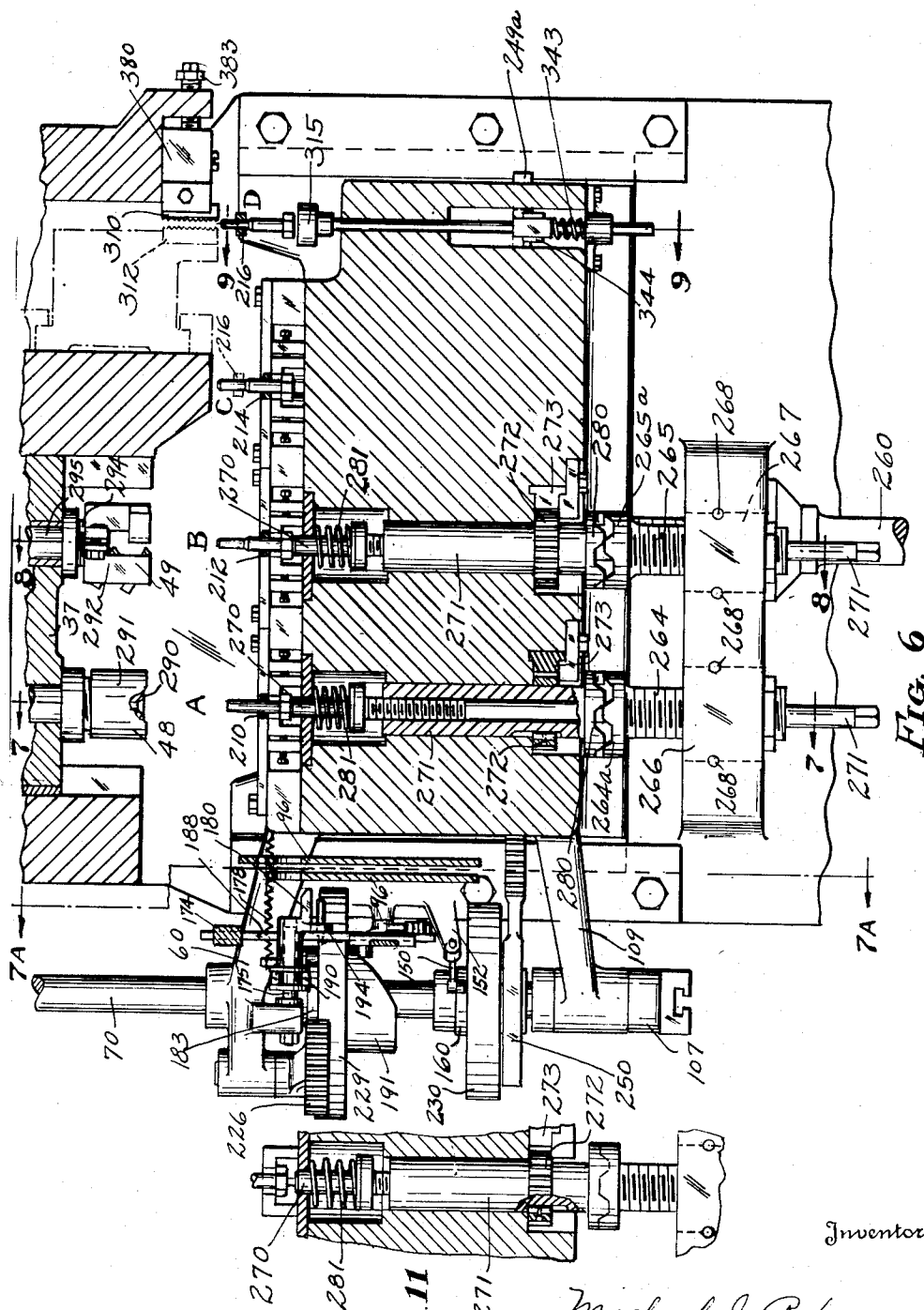


Fig. 6

Fig. 11

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10 Sheets-Sheet 6

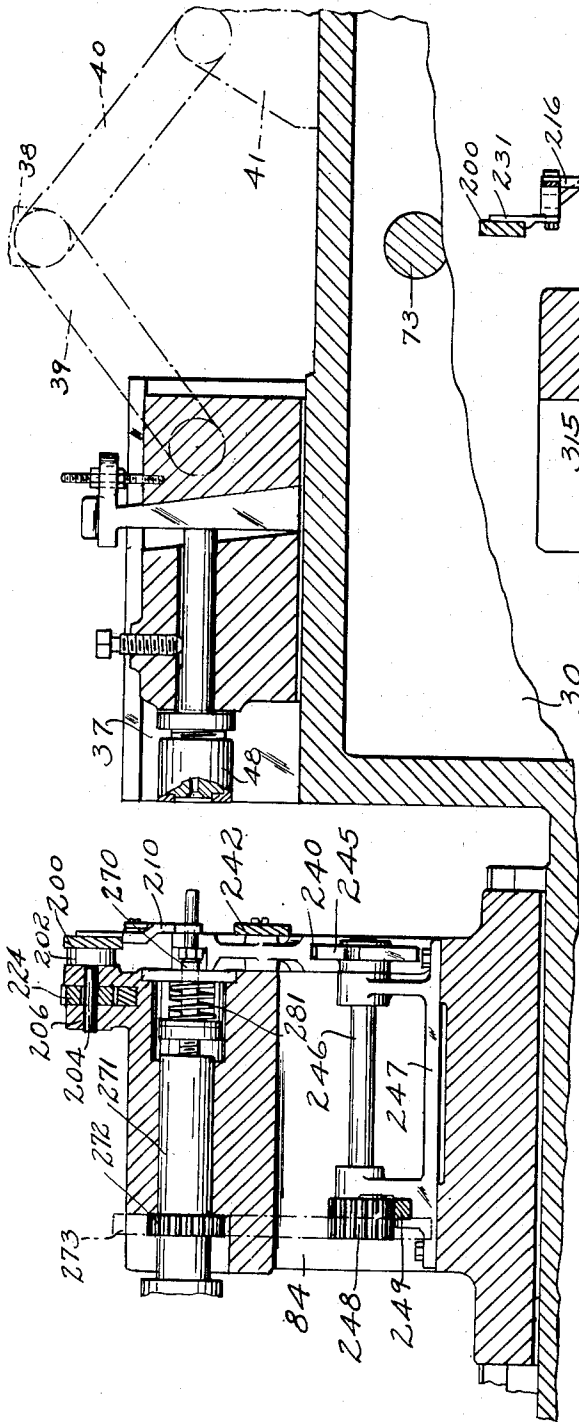


FIG. 7

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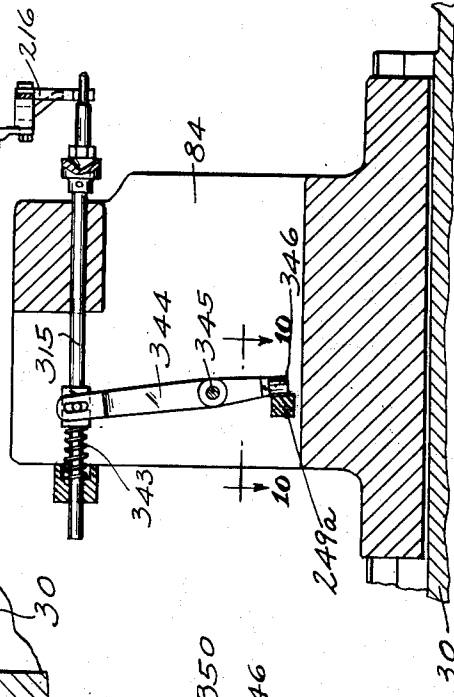


FIG. 9

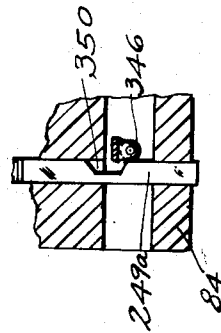


FIG. 10

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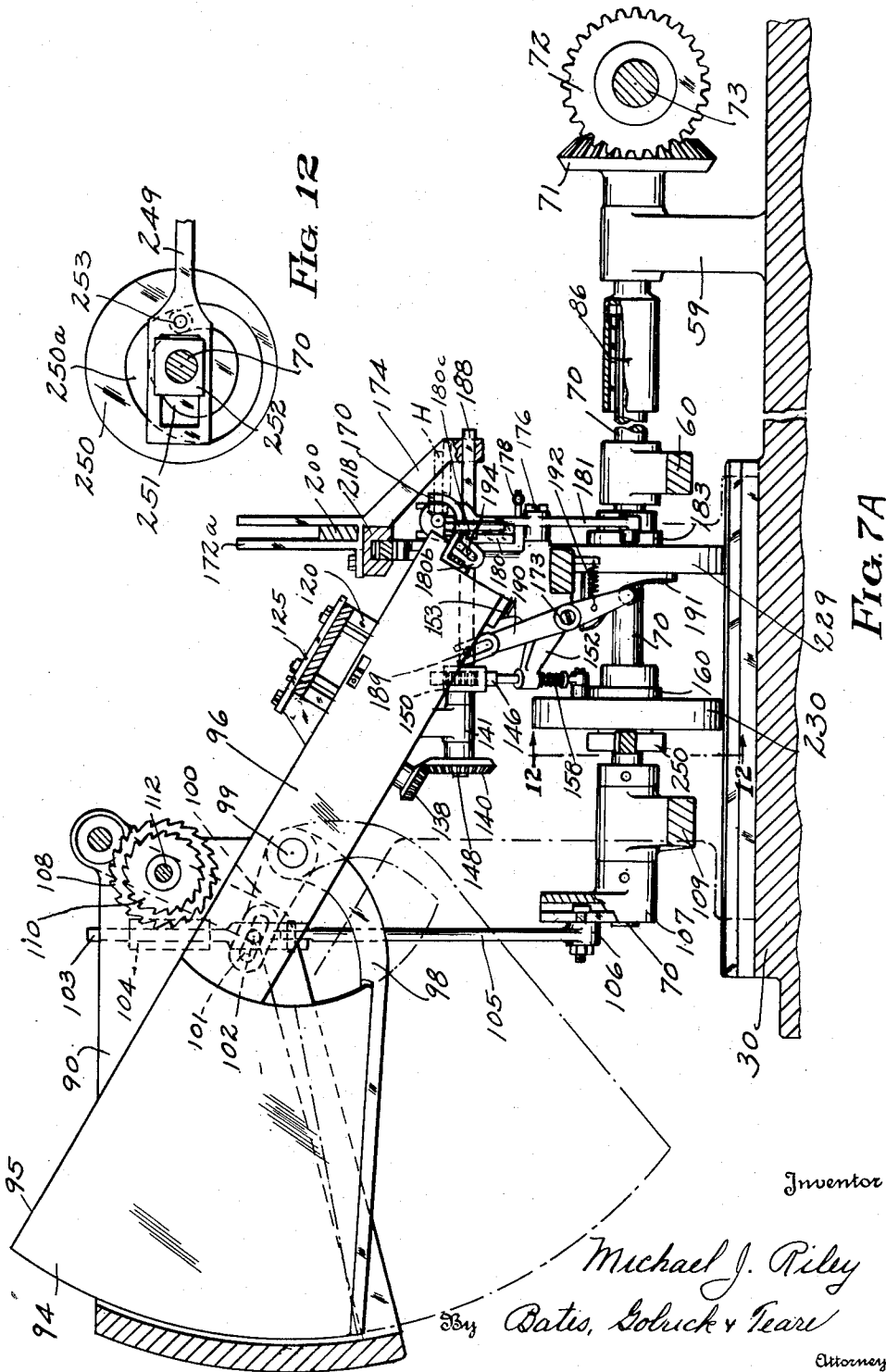
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10 Sheets-Sheet 7



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BOLT MACHINE

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10 Sheets-Sheet 8

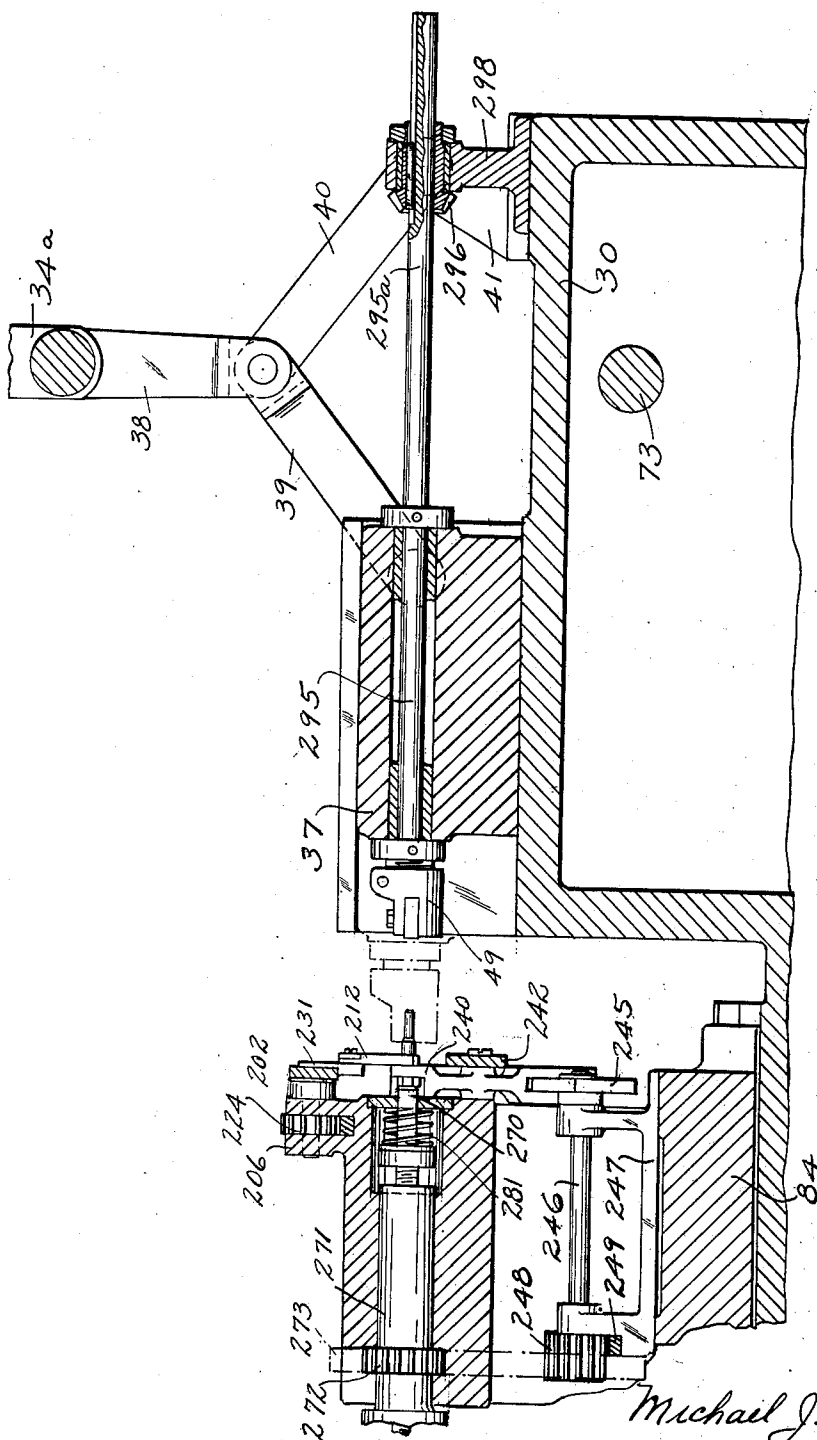


FIG. 8

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10 Sheets-Sheet 10

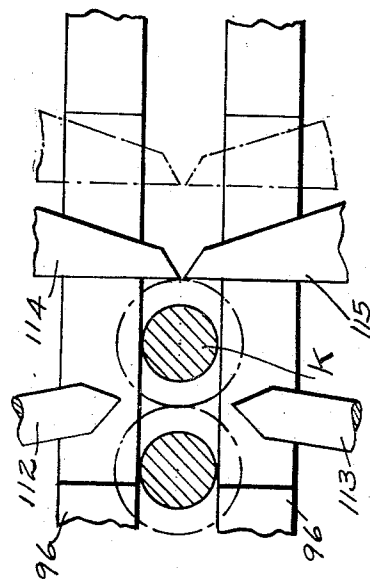


FIG. 17

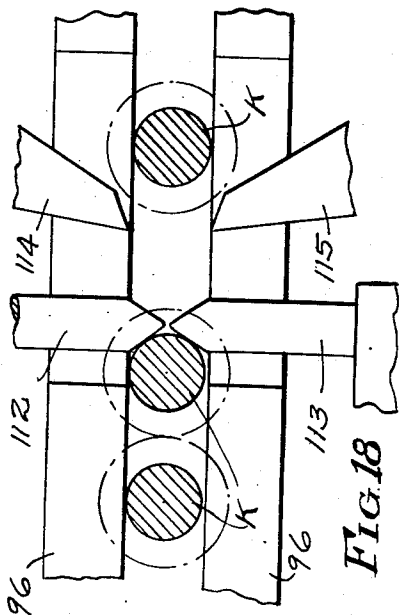


FIG. 18

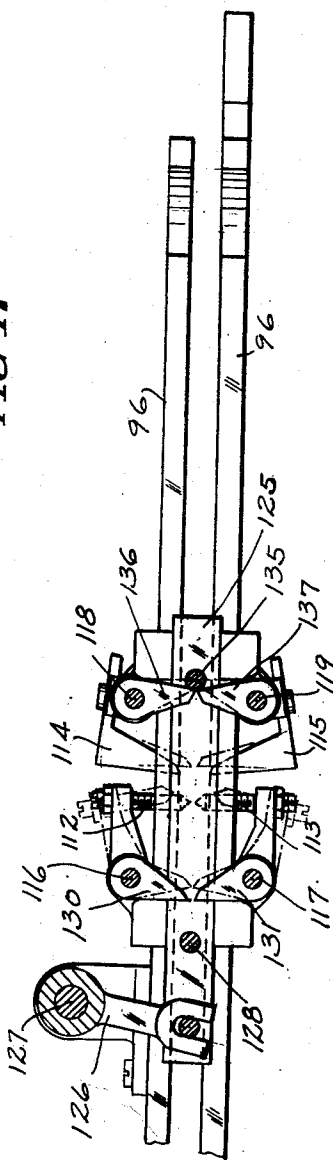


FIG. 16

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UNITED STATES PATENT OFFICE

2,020,657

BOLT MACHINE

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corporation of Ohio

Application June 4, 1932, Serial No. 615,368

43 Claims. (Cl. 10—11)

This invention pertains to bolt machines, and the general object thereof is the provision of an automatic machine for effecting a plurality of metal working operations simultaneously on several work blanks.

A further object of my invention is the provision of such a machine and which is adapted to effect extruding, trimming, cutting, and thread forming operations on screw products.

A still further object is the provision of a bolt working machine having mechanisms incorporated therein adapted to automatically feed bolt blanks to the machine and to move the blanks from station to station in said machine, whereby successive operations may be performed upon the bolt blank by other mechanisms comprising part of the machine and all operations are performed substantially simultaneously in a single machine. A still further object of my invention is to employ mechanisms for effecting the foregoing referred to operations, which mechanisms shall be coordinated and controlled in such manner that high speed accurate production of finished work pieces may be effected.

A further object of my invention is to provide an automatic machine for extruding the thread receiving portions of the shanks of a series of bolt blanks, pointing the ends of the shanks and rolling threads upon the extruded portions, while positively maintaining the bolt blanks in the same consecutive order through each of these operations. In this way the lapse of time between any two operations on each blank of the series remains constant so as to avoid any possibility of age hardening affecting the uniformity of the product. At the same time the wear of the extrusion die during service cannot interfere with the accuracy of the threads rolled upon the shank, since as the extrusion die wears and as a consequence the portion of the shank extruded thereby becomes larger, the roll threading dies may be adjusted to maintain at all times a spacing of the roll threading dies giving the most desirable thread and avoiding any danger of making the threaded portions oval or in any way injuring the metal of the blank.

A further object of my invention is the provision of a novel thread rolling machine having features for automatically pointing and feeding a bolt to the thread rolling dies.

A further object of my invention is the provision of a novel device for accurately and efficiently bodily transferring a plurality of work pieces in successive manner to each of a plurality of mechanisms, adapted to perform differ-

ent operations on the work pieces. The transfer mechanism is claimed in my co-pending application Serial No. 6,934, filed February 5, 1935.

Other objects of my inventions will hereinafter become apparent from the description thereof and which description refers to the accompanying drawings, the drawings disclosing preferred embodiments of the inventions.

In the drawings, Fig. 1 is a side elevation of an automatic machine embodying the features of my invention. Fig. 2 is a transverse cross-sectional vertical elevation taken through the machine, substantially along the plane defined by the line 2—2 of Fig. 1. Fig. 3 is a cross sectional elevation as viewed along the line 3—3 in Fig. 1 and illustrates the transfer mechanism claimed in said co-pending application. Fig. 4 is a longitudinal elevation of the machine with parts in section. Fig. 5 is a plan view of part of the mechanism shown in Fig. 3 and is indicated by the line 5—5 of Fig. 3. Fig. 6 is a cross-sectional plan view taken substantially along the line 6—6 in Fig. 1. Fig. 7 is a longitudinal cross-sectional fragmentary view of part of the mechanism shown in Fig. 6 and taken substantially along the line 7—7 of Fig. 6. Fig. 7A is a cross-sectional side elevation through a work holding hopper, work raceway and work segregating device, and the plane of this section corresponds substantially to the line 7A—7A of Fig. 6. Fig. 8 is a similar cross-sectional view taken along the line 8—8 of Fig. 6. Fig. 9 is a fragmentary cross-sectional view taken substantially along the line 9—9 of Fig. 6. Fig. 10 is a cross-sectional detail view taken substantially along the line 10—10 of Fig. 9. Fig. 11 is a cross sectional plan detail of part of the mechanism shown in Fig. 6, but showing the operating elements thereof in a position different than that of the same elements as viewed in Fig. 6. Fig. 12 is a fragmentary detail in side elevation of part of the mechanism shown in Fig. 7A. Fig. 13 is an enlarged side elevation of the work segregating mechanism shown in Fig. 7A. Figs. 14 and 15 are transverse cross-sectional views of part of the segregating mechanism shown in Fig. 13, as viewed along the planes defined by the lines 14—14 and 15—15, respectively, of Fig. 7.

My invention contemplates a combination of mechanisms incorporated in a single machine to effect the performance of various operations on a work piece in a completely automatic manner, whereby the work pieces may be deposited in a hopper and be selected therefrom and subsequently segregated one at a time while positioned

in a raceway, whereby a single work blank is automatically horizontally positioned to be engaged by a gripper mechanism, which will transfer the work from one group of mechanisms to an adjacent group of mechanisms, and still further to a third group of mechanisms, whereby the distinctive operations of each group of mechanisms may function to perform an operation on the work piece. The association of these mechanisms to the work transferring and gripping mechanisms is such that three different operations may be simultaneously performed upon three different pieces of work or the operations may be performed on a single work piece in a successive manner. The particular operations in the instant embodiment of my invention, are adapted to perform an extruding operation on the shank end of a bolt blank, a subsequent pointing operation which points the end of the shank, and finally a thread forming operation on the extruded, pointed end of the blank.

The mechanisms disclosed in the drawings comprise primarily a hopper mechanism to which the bolt blanks may be indiscriminately dumped; mechanism to cause the hopper mechanism to upend and select the bolt blanks from the hopper, whereby the bolt blanks escape from the hopper to a raceway in head-up position; a work piece segregating mechanism associated with the raceway, whereby a single work blank may first be segregated from a plurality of bolt blanks present in the raceway, and which segregated piece may thereafter be permitted to escape from the raceway to a positioning means, which holds the bolt blank in a substantially vertical position from where it is swung to a horizontal position.

I also provide a work transferring mechanism in the form of a series of equidistantly spaced, simultaneously operated work gripper fingers, which, when operated progressively and intermittently, advance the bolt blank from the horizontal positioning means to a chuck associated with the extruding mechanism, which mechanism serves to reduce a portion of the bolt shank. The gripper fingers thereafter engage the bolt blank and shift it sideways to a trimming mechanism and thereafter through two successive intermittent, transverse movements of the bolt blank the bolt blank is presented to a thread rolling mechanism in an accurately positioned manner, whereupon the threads are formed on the extruded portion of the bolt blank, and the completed article is then permitted to fall into a suitable receptacle. All of the foregoing referred to mechanisms have associated therewith suitable operating gears, cams, levers, and shafts, arranged in such manner that all movements of the various elements of the mechanisms comprising the machine can be coordinated in timed relation, whereby accurate high speed reduction may be effected; and further, the supporting elements for all such mechanisms are arranged in such manner that the machine may be set up and tooled for effecting operations upon work of different lengths and cross-sectional size.

The machine generally may comprise a base of suitable weight and design to support, in a precision manner, the various mechanisms comprising the machine. The upright portion 31 of the machine frame, (see Fig. 1), is adapted to support a crank shaft 34, and this crank shaft is suitably powered from any source, such as belt 35 and fly-wheel 36. From the crank shaft power is imparted to a horizontally acting slide 37 (see Figs. 1 and 2) by a toggle mechanism, compris-

ing a connecting rod 38 attached at the upper end to the crank of the shaft 34 and at its lower end to toggle arms 39 and 40, the latter arm having its lower end suitably pivotally connected to the machine frame at 41, while the forward arm 39 has the lower end thereof suitably connected to the slideway 37 at 42. The slideway 37 is of substantial design and suitably supported in the longitudinally extending slideway 43, formed in the upright portion 31 of the machine frame 30; the slideway and slide operating longitudinally of the machine to carry pointing tools and an extruding die to and from the work, as for example, extruding mechanism 48 and pointing mechanism 49, which last two named mechanisms will be hereinafter described in detail.

For the purpose of operating a thread rolling mechanism, the crank shaft 34 has mounted on the right-hand end thereof, as viewed in Fig. 2, an arm 50, comprising part of a Scotch yoke mechanism for operating a vertical slide 51, which vertical slide 51 carries the reciprocating member of a pair of thread rolling dies. The Scotch yoke mechanism comprises in addition to the slide arm 50, the slide block 52, which is operated by a crank and pin 53, the crank and pin 53 being carried by a stud shaft 54, upon which is keyed gear member 55 (see Figs. 1 and 2). The gear 55 is driven by a gear 58, mounted on the end of the crank shaft 34. The upper forward end of the arm 50 is pivotally connected to a link member 56, which is suitably pivotally connected at 57 to the upper end of the vertical slide 51. Thus the crank shaft 34 effects vertical reciprocation of the thread rolling die slide 51 in a manner obvious to those skilled in the art. A further description of the thread rolling mechanism will be hereinafter set forth.

In order to transfer power to the forward end of the machine, whereby the hopper mechanism, work segregator mechanism, chucks and transferring mechanism, may be driven from the crank shaft 34, I provide a longitudinally extending shaft 70 at the lower left of the machine, as viewed in Fig. 2. This shaft 70 has mounted on the rear end thereof a bevelled gear 71 (see Figs. 1 and 7A), the shaft 70 being supported in any suitable manner in the machine frame 30 by brackets 59, 60 and 109 (see Fig. 7A), whereby the bevel gear 71 may be driven by a companion bevel gear 72, which is mounted upon transversely disposed shaft 73, extending through the lower part of the rear of the machine frame. Upon the outside of the upright portion 31 of the machine frame, I provide a spur gear 75, which may be driven by the crank shaft gear 58 (see Fig. 1) through the medium of an intermediate idler gear 80, the idler gear 80 being suitably supported on a stud 81, the stud being secured to the side of the upright portion of the machine frame 31. The shaft 70 has mounted thereon at the forward end thereof and within a frame member comprising a chuck head frame 84, a series of cams which operate the work transferring mechanism, work holding chucks, the hopper and the work segregating means and other mechanisms, all of which will be described hereinafter in detail.

The hopper mechanism may comprise a hopper body 90, which is suitably rigidly supported in a convenient manner upon the machine frame 30 by upright bracket members 61, attached to the top of the chuck head frame 84. The hopper body 90 may be of a convenient width and with sloping sides to hold quite a number of work pieces, and the sides slope to a longitudinal bottom opening.

A pair of parallel work selecting plates 94 are disposed to oscillate in unison within the hopper and through said slot, whereby work pieces are caused to be disposed between the work selecting plates with the bolt heads engaged by the top edges 95 thereof. When the members 94 are swung upwardly to the position shown in Fig. 7A, the top surfaces 95 of the plates 94 will lie in a common plane with the top surfaces of two spaced apart parallel bars 96, which form the raceway onto which the bolts are permitted to slide when once engaged between the plates 94 and raised to the position shown in Fig. 7A. The plates 94 are rigidly supported by arms 98 which arms are pivotally mounted on a pin 99 to permit the plates and arms to be oscillated as a unit from the extreme upward position shown in Fig. 7A to the lowermost position, as indicated by the dot and dash lines shown in Fig. 7A, whereby the top surface 95 of the plates are brought down to the inner bottom surface of the hopper. Oscillating action of the plates 94 is effected through the medium of a crank arm 100, shown dotted in Fig. 7A, and this crank arm is provided with a slot 101 at its outer end for the reception of a roller and pin indicated at 102; the roller and pin are mounted upon a vertically reciprocal bar 103, the bar 103 being suitably supported in a boss bearing 104, formed on the outer side wall of the hopper body 90. The lower end of the pin 103 is pivotally connected to a crank rod 105, as indicated at 106, and the crank rod 105 effects vertical reciprocation of the pin 103. The bar 105 is actuated by an adjustable crank pin 106 and which crank pin is carried by a crank arm 107. The crank arm 107 is mounted upon the forward extremity of the shaft 70 which is suitably supported by the bearing member 109, connected to the chuck head frame.

I provide an ejector mechanism in association with the hopper, which serves to eject any bolt blanks which may become disposed lengthwise of the plates 94 on the top faces 95 thereof. This mechanism may take the form of spur wheels 108 and 110, and which wheels may be mounted in any suitable manner, as, for example, upon a small shaft 112, suitably rotatably supported by the hopper body 90 at a position immediately above the top surfaces of the raceway plates 96. The wheel 110 is spaced above the top surface 96 of the raceway plates a sufficient distance to permit a bolt head to pass downwardly under the influence of gravity between the raceway bars 96, but should a bolt be mispositioned the wheels 108 and 110 will serve to kick the same back into the hopper.

I provide a work piece segregating mechanism in immediate association with the raceway leading from the hopper, which serves to segregate one bolt blank from the remaining bolt blanks tending to slide down the raceway, and this segregating mechanism functions to permit the escape of a single segregated work piece along the raceway and drop therefrom, whereupon the bolt blank is presented in a vertical position with head up to a blank positioning means that is adapted to swing the blank to a horizontal position, at which position the blank may be engaged by gripper fingers, to be described. This segregating mechanism is illustrated in detail in Figs. 13 to 18 inclusive. In Fig. 13 the continuation of the raceway plates or rails 96 comprises the lower part of the raceway. Diagrammatically illustrated in Figs. 17 and 18, I show a pair of stop members comprising swingable fingers 112 and 113, dis-

posed immediately below the top surfaces of the raceway bars 96. The fingers are of such shape and size as to extend from opposite sides of the raceway plates 96 to substantially the center of the runway thereof, whereby these fingers, when in the position shown in Fig. 18, serve to intercept the lowermost of a series of horizontally positioned bolt blanks, which are tending to slide downwardly out of the raceway under the influence of gravity.

A second set of oscillating fingers 114 and 115 are similarly arranged a short distance below the operating position of the fingers 112 and 113 and mechanism is provided to alternately oscillate these two pairs of fingers, whereby an escapement action is obtained on the lower one of the row of bolt blanks in the raceway. In Fig. 17 fingers 112 and 113 are shown as having been swung outwardly from the center of the runway of the raceway, thus permitting the bolt K to slide downwardly and contact with the lower pair of fingers 114 and 115. The actuating mechanism is such that when the upper fingers 112 and 113 are swung outwardly, the lower fingers 114 and 115 are disposed inwardly. Further operation of the mechanism will cause the fingers 112 and 113 to assume the position shown in Fig. 18, while the fingers 114 and 115 are shown as having been swung outwardly, thus permitting the bolt blank K to individually escape down the raceway while the remaining bolts are retained by fingers 112 and 113.

The mechanism for actuating these two pairs of fingers may comprise a pair of vertical shafts 116 and 117 to which the fingers 112 and 113 are respectively rigidly attached, and a pair of shaft members 118 and 119 to which the lower set of fingers 114 and 115 are rigidly attached. These shaft members are respectively supported by a vertically extending bracket 120 that is of a shape to straddle the raceway bars 96 and which bracket is secured to the raceway plates 96 in any suitable manner such as machine screws 121. As shown in Fig. 13, the raceway plates 96 are provided with side openings 122, which openings are formed in the raceway plates 96 adjacent the bolt head sliding surfaces of the raceway plates 96, whereby the respective pairs of fingers engage the bolt blank slightly beneath the head of the blank. The two pairs of bolt engaging fingers and vertically extending shafts which support them are actuated as follows:

Suitably positioned on the top of the bracket 120 is a slide member 125, which is reciprocated by a bifurcated arm 126, which arm is suitably attached to the upper end of a vertically extending rocker shaft 127. The slide 125 is provided with a vertically extending pin 128, which, when the slide is reciprocated, acts upon cam arms 130 and 131 respectively, affixed to the upper ends of the vertical shafts 116 and 117. When the pin 128 is moved downwardly the cam arms 130 and 131 are rocked in a downward, outward direction, thus causing swinging of the shafts 116 and 117 and the fingers 112 and 113 are thus swung to the position shown in Fig. 17. The position shown in Fig. 16 of the pin 128 and cam arms 130 and 131 is the position of these members when the fingers 112 and 113 are located as shown in Fig. 18. A second pin 135 is provided on the slide 125 and similarly acts upon a pair of cam arms 136 and 137, and which cam arms are respectively affixed to the top ends of the vertical shaft members 118 and 119. However, the action of the pin 135 is reverse to that of the pin 128

in that when the slide moves upwardly the fingers 114 and 115 are caused to be swung to the position shown in Fig. 18. The power for actuating the foregoing described finger mechanisms is obtained through a bevel gear pinion 138, mounted on the lower end of the vertical shaft 127 and the pinion 138 is caused to have an oscillating movement by an oscillating bevel gear 140. The bevel gear 140 is mounted upon a shaft 148, and which shaft is supported by a bracket 141, comprising a depending portion of the bracket 142 and which bracket 142 suitably supports the vertical shaft 127. The bracket 142 is suitably attached to one of the raceway plates 96. Oscillation of the bevel gear 140 is effected by a reciprocating rack bar 146 (see Figs. 13 and 16). The rack end of the bar 146 is supported by a loose bearing member 147, which bearing member is supported by a shaft 148, and the shape of the bearing member 147 is such as to conveniently span a spur gear pinion 150, suitably mounted on the inner end of the shaft 148. The rack bar 146 has the lower end thereof supported by a bracket member 152, comprising part of the bracket 153 and which latter bracket supports the lower end of the raceway plates 96. Reciprocation of the rack bar 146 is effected in a downward direction by a spring member 158 in an obvious manner and the upward, positive movement of the rack bar is effected by a cam 160 and which cam is mounted upon the longitudinally extending general cam shaft 70.

As the bolt blank K is permitted to escape downwardly along the raceway plates 96 by the lower pair of fingers 114, 115 of the segregator mechanism, the bolt is dropped onto a pair of spaced apart, curved rails which may comprise extensions 170 of the lower ends of the raceway bars 96, and I provide a suitable mechanism which may be positioned first behind the bolt blank as it rests head-up on the extensions 170, and which will thereafter swing the bolt through a 90 degree movement into a horizontal position shown by the dot and dash lines at H in Figs. 7A and 13. This mechanism is such as to support the bolt in the horizontal position shown until the bolt blank shank can be engaged by a pair of transfer fingers, which are adapted to remove the bolt in a lateral arcuate swing to the center line of the first chuck and the extruding mechanism. This mechanism may comprise a specially formed sleeved arm 180, which is caused to shift in a transverse direction inwardly behind the bolt blank, and thereafter swing the blank through a 90 degree arc. This arm is shown in Figs. 3, 6 and 13, as a sleeve slidably mounted upon a rigid supporting pin 175. The mounting is such that the member 180 may also be swung 90 degrees with the center of the pin 175 as an axis. In the positions shown in these figures the arm is in inoperative position and is actuated from right to left in Fig. 3 by a lever 181, having the upper end thereof bifurcated to engage in the spool formation 180a, formed on the arm 180. That portion of the arm 180, which engages the bolt is bevelled, whereby the bolt nests between the plate extension 170 and the bevelled surface when the bolt blank is being swung and when horizontally at rest. A notch 180c formed in the arm 180 affords clearance for the ends of the gripper fingers. The lever 181 is pivotally mounted at 176 on a stud which is fixed to a frame member 177 carried by the chuck bead frame 84. The frame member 177 also supports the pin 175. The lever 181 has a

roller 182 provided on the lower end thereof to suitably engage an actuating cam 183, which is mounted upon the shaft 70. The lever 181 is actuated outwardly to the inoperative position shown in Fig. 3 by the positive action of the cam 183 and is swung inwardly by a spring member 178 attached to the upper part of the lever 181 and to the chuck head frame. Hence, when the spring 178 causes the member 180 to shift from right to left of Fig. 3, the pedestal part of the member 180 is brought into a position behind the bolt blank, after the bolt blank has dropped from the raceway between the members 170. The arcuate swing of the arm 180 to position the bolt horizontally is effected by the longitudinal movement of a bar 188 (see Figs. 3, 6 and 7A) in the following manner. The bar 188 is slidably supported in a bracket 174, supported by the chuck head frame 84. The sliding movement of the bar is transverse to the axis of the supporting pin 20175 and the bar is provided with a pin 189 at its inner end, which is engaged by the upper bifurcated end of a lever member 190. The lever member is pivotally supported on stud 173, which is fixed to the frame member 177. The lever 190 may be actuated in one direction by a barrel cam 191, suitably attached to the shaft 70. Actuation of the lever in the opposite direction may be effected by a spring 192. The bar 188 is provided with a second pin 194, which engages in a slot formed in a branch arm 180b, comprising an integral part of the arm 180.

Thus a movement of the bar 188 from left to right, see Fig. 7A, will cause the pin 194 to act on the portion 180b of the arm 180 and effect a swinging movement thereof in its bearing, and the bolt is thus swung to the position shown in dot and dash lines (see Figs. 7A and 13). The camming relation between the cam 160 which actuates the segregator mechanism and the cams 183 and 191 which actuate the bolt swinging mechanism, is such that the arm 180 will not be positioned inwardly behind the bolt vertical resting position until a bolt has been permitted to escape downwardly by the segregator mechanism and the arm 180 is then swung about pinions 175 through 90 degrees and is held in horizontal bolt supporting position a sufficient time to permit the gripper fingers to engage the bolt and remove it from the pedestal of the arm 180. It will be noted that the pedestal portion of the arm 180 is shaped to nest the bolt blank shank and the members 170 have arcuate surfaces to guide the head of the blank, and as shown in Fig. 13, a notch 170a in the member 170 gives clearance for the ends of gripper fingers to engage the horizontally supported bolt blank.

To present the bolt blank to the respective chucks which are associated with the extruding and trimming mechanisms, I provide four sets of depending gripper fingers, which are mounted upon a common bar 200, extending transversely of the machine above the chuck centers, whereby the sets of fingers are moved in unison. The fingers are actuated also in timed relation to the actuation of the extruding, pointing and thread rolling mechanisms and the chucks. The bar supporting the fingers is mounted upon parallel motion links, whereby any point in the bar is caused to swing through an arc of 180 degrees. The bar is guided by slotted bracket members 172 and 172a, the latter comprising part of the frame member 174. The center lines of the chucks and the bolt operating mechanisms are equidistantly spaced and are in a common plane

with the center line of the bolt blank when the bolt blank is being horizontally supported on the pedestal of the swinging arm 180.

In Figs. 3, 4, 5, 6 and 7, the transversely disposed bar 200 is illustrated in various ways. The bar 200 (see Figs. 3 and 5), is mounted upon a pair of links 201 and 202, which are suitably supported by stud pins 203 and 204, respectively. The pins 203 and 204 are revolvably supported by bearing brackets 205 and 206, respectively, the bearing brackets being suitably attached to the top of the chuck head frame 84, adjacent the inner edge thereof, whereby a plurality of gripper fingers 210, 212, 214 and 216 may depend from the bar 200 and overhang the upper, inner face of the chuck head frame. The fingers 210, 212 and 214 are in transverse alignment with the slot 170a formed in the extensions 170 of the raceway plate 96. The links 201 and 202 are swung through a movement of 180 degrees by actuation of pinions 223 and 224, suitably mounted upon the link stud pins 203 and 204, and the pinions are actuated by a rack 225, which rack is supported in a suitably formed slideway in the top of the chuck head frame 84, and by a guide plate 218 extending outwardly from the top of the chuck head frame 84 over the cam shaft 70. The rack is reciprocated by a fan gear 226, see Fig. 5, formed on the upper end of a lever 227, supported on a stud 219 carried by the frame member 177. The lower end of the lever is provided with a roller 228, which is disposed within the groove 229 of the cam member 230, the shape of the camming surface of the cam member 230 being such as to cause the fan gear 226 to impart sufficient motion to the rack 225 to cause the pinions 223 and 224 to be revolved one-half revolution, thus causing the bar 200 to be swung by the links 201, 202, as indicated by the dot and dash arcs 200a (see Fig. 3) and to cause the bolt blanks carried by the fingers 210, 212, 214 and 216 to be swung through the arcs, indicated by the dot and dash lines 208. The fingers may be of the shape shown in Fig. 3 and may be supported on pins 230, which pins are suitably supported by bracket members 231, the bracket members being affixed to the bar 200 in any convenient manner. Leaf spring members 232 are attached to the bracket members 231 in such manner that the lower free ends thereof may tend to keep the fingers in a closed or blank gripping position. The lower ends of the fingers are shaped to permit the spreading thereof when brought into engagement with the bolt blank shank, whereby they may be caused to slip into and out of engagement with the shank of the bolt blank by the forceful actuation of the bar 200 in opposition to the tendency of the leaf springs 232 to maintain the fingers closed.

I have provided chucks at stations A, B and C, which are adapted to firmly engage the shank of the bolt blank immediately adjacent the head of the blank, and the chuck at station A cooperates with the extruding mechanism, while the chuck at station B cooperates with the pointing mechanism to hold the bolt blanks while operations are being performed thereon. The chuck provided at station C is merely intermediate in its function and serves to hold a bolt blank while the pair of fingers 214 are being swung to the right to assume the position of the fingers 212 and to firmly hold the bolt while the fingers 216 are caused to engage the bolt blank. The position of the fingers 216 shown in Fig. 3 is the position at which the bolt blank is shifted in a transverse direction to present the blank to the thread roll-

ing mechanism. This operation and the elements for the effecting thereof will be hereinafter described in detail, but it is here desired to point out that the fingers 216 are not in transverse alignment with the other pairs of fingers but are positioned somewhat forwardly, as indicated in Fig. 5, to grip the bolt blank a substantial distance away from the head of the bolt blank, and thus serve to more accurately function to guide the end of the bolt blank shank into the thread rolling dies.

A description of the chuck and the actuating mechanism therefor shown at station A will suffice for the description of the chucks shown at B and C, where the mechanisms may be identical. In Figs. 3, 4, 7 and 8 and Fig. 7A and 12, the various elements comprising the chuck and the operating elements therefor are shown. The chucks comprise pairs of opposed rockable arms 240 of substantial design and which are mounted upon horizontally disposed pins 241 supported by the chuck frame head 84 on the inner or forward vertical transverse face thereof. The forward ends of the pins 241 (see Fig. 3) are supported by plate members 242, which are suitably bolted to the chuck frame head 84 in any convenient manner. The upper ends of the chuck arms 240 carry adjustable chuck blocks 243, the jaws of which are suitably shaped to conform to the shape of the work and in this instance, as stated, a bolt blank shank. The lower ends of the chuck arms 240 are provided with friction rollers 244, which are engaged by rockable cam plates 245. The cam plates are mounted on stud shafts 246, suitably supported by bracket members 247, the bracket members being bolted to the chuck head frame 84. Mounted upon the studs 246 are pinions 248, which are actuated by a rack bar 249, the rack bar being suitably slidably supported in operative relation to the pinions 248 by the chuck head frame 84 and by brackets 247, whereby reciprocation of the rack bar 249 will cause slight oscillating movement of the pinions 248 and accordingly, the camming plates 245, thus causing the chuck arms to be swung open and closed. It will be noted in Figs. 7 and 8 that the camming plates 245 are disposed at the inner end of the stud shafts 246, while the pinions 248 and rack bar 249 are supported at the rear or outer end of the chuck head frame 84. In order to effect the operation of the chucks in timed relation to the movements of the work transferring fingers, the rack bar 249 is actuated by a closed face cam 250 (see Figs. 7A and 12) the cam being mounted upon the shaft 70, the outer end of the rack bar 249 being provided with a rectangular slot 251, which engages a bearing block 252, loosely mounted on the shaft 70, whereby other than a transverse horizontal movement of the rack bar 249 will be prevented. A roller 253, mounted upon the rack bar 249 and engaging in the slot 250a of the cam 250, is actuated by rotation of the cam, and thus the rack bar movements are positively controlled in both directions.

From the foregoing description of the chuck actuating mechanism, it will be apparent that the shape of the cam 250 and the angular disposition thereof upon the shaft 70, relative to the cams 160 and 183 and 230, predetermines the transverse blank transferring movements of the sets of fingers 210, 212, 214, and 216, in timed relation to the movement of the blank from the segregator mechanism to the horizontal positioning thereof.

In order that the bolt blanks will have one end thereof definitely positioned relative to the ex-

truding and pointing mechanism, I provide means associated with the chucks at stations A and B for shifting the bolt blank longitudinally of its axis after it has been placed in the chuck jaws and before the chuck jaws have been finally locked upon the work, whereby the underside of the head of each bolt blank is forced against the inner vertical end surface of the chuck jaws. I incorporate this means in the chuck head frame 84 in such manner that this means may also serve to transfer any undue longitudinal strains exerted upon the bolt blanks when being operated upon by the extruding mechanism directly to the bed of the machine frame, thus protecting the various operating elements of the chuck head. In Figs. 1 and 6 I show a solid block of metal 30a, extending upwardly from the bed 30 of the machine frame in the rear of the chuck head frame 84. This portion 30a of the machine frame serves to support in a suitable manner an adjusting screw 260, which screw may be manually turned by a wheel 261 to effect longitudinal adjustment of the chuck head frame 84 for different lengths of work. It will be noted in the drawings that the chuck head frame has the bottom thereof shaped to comprise a slide which fits in a slideway formed in the base of the machine frame 30, whereby it may be firmly clamped to the base in adjusted position by the guideway clamping plates 85. The shaft 70 is provided with a splined coupling 86 (see Fig. 7A) whereby such adjustment is permitted without disturbing the driving action of the rear and forward parts of the shaft 70.

In the upper part of the machine frame portion 30a, I provide adjustable threaded back-up sleeves 264 and 265, which are in threaded engagement with the bushing members 266 and 267, respectively. These sleeves also serve as fixed cam members and are retained in place on the fixed frame portion 30a by the bushings 266 and 267, which bushings are retained by small pins 268 and which pins are adapted to shear, should any undue strains be exerted upon the chuck operating elements, as will be described.

To position the bolt blanks longitudinally while in the chucks, I provide a slight longitudinal shifting movement of back-up rods 270, the inner ends of which rods engage the top faces of the bolt blank heads. The rods 270 are in threaded engagement with the sleeve members 271 for adjusting purposes and extend rearwardly and freely through the back-up sleeves 264 and 265. The sleeve members 271 are adapted to shift longitudinally of the bolt blank and to be axially turned through a small part of one revolution by pinions 272. The pinions are longitudinally fixed by the chuck head frame 84 and are actuated by vertically extending rack bar members 273. The rack bar members are suitably supported in vertical operating position by slideways formed in the chuck head frame 84, and the pinions 272 are so positioned on the sleeves 271 that the vertically extending rack bars 273 may extend downwardly and engage with and be operated by the chuck arm operating pinions 248, (see Figs. 6 and 8). The outer ends of the sleeves 271 are provided with camming heads 280, the camming surfaces of which are complementary to the camming surfaces formed on the inner ends of the sleeves 264 and 265.

Hence a slight turning or revolving movement of the sleeve 271 will cause the cam heads 280 thereof to ride up upon the camming surfaces of the heads 264a and 265a of the fixed back-up

sleeves 264 and 265, thus causing the sleeves to shift the back-up pins 270 into engagement with the heads of the bolt blanks held by the chuck jaws. This longitudinal shifting or positioning of the bolt blanks in the chuck jaws is effected just prior to the final cinching or locking action of the camming plates 245, and accordingly, I control this timing movement by a predetermined relationship in the amount of movement required of the vertically disposed rack bars 273 actuated off of the chuck actuating pinions 248 and the contour of the camming surfaces of the camming plates 245.

In Fig. 11 I show the relationship of the various elements just described when the back-up pin is away from the head of the bolt, while in Fig. 6 I show the relationship of these elements after the rack bar 273 and pinions 272 have caused a slight revolving movement of the sleeves 271, thus causing the back-up pins 270 to wedge the bolt heads against the inner end faces of the chuck jaws. When the sleeves are revolved in a reverse direction, the springs 281 cause the sleeve to assume the position shown in Fig. 11 in an obvious manner. Should any unusual strain be exerted upon the back-up pin 270, such strain will be transmitted to the sleeve 271 by reason of the threaded engagement thereof with the thrust pin 270 and by the cam head 280 of the sleeve 271 to the head 264a and the thrust member 264, thus causing the pins 268 to shear and permit the bushings 266 to be forced backwardly and outwardly.

After a bolt blank has been positioned at station A, and the chuck has firmly closed thereupon, actuation of the slide 37, which carries the extruding die 48, if effected by reason of the timed relation of the angular disposition of the crank arms 34a, crank shaft 34, train of gears, comprising 58, 80, 75, transverse shafts 73, bevelled gears 71, 72, shaft 70 and the series of cams hereinbefore described as being mounted on the shaft 70, and which cams actuate the work segregator mechanism, the work positioning means, the swinging bar carrying the gripper fingers, the locking of the chucks and the longitudinal positioning of the work in the chucks.

As the slide 37 is shifted outwardly toward the shanks of the bolt blanks held by the chuck at station A and station B, the work blank at station A has the shank thereof reduced in diameter by an extruding die 290, supported by an adjustable die holder 291. The slide 37 is moved away from the work stations A and B to free the blanks from the tools carried by the slide and in this connection it will be observed that since the extruded blanks are rigidly held by their heads as the slide moves away from the blank, it is unnecessary to provide any knockouts or analogous mechanism. This outward movement of the slide 37 also causes a second work blank, the shank of which had previously been extruded at station A and thereafter transferred to station B, to be pointed by a cutting mechanism which may be in the form of a box tool 292, which is suitably rotatably supported at the forward end of the slide 37. This box tool may have cutters for trimming the shoulder of the shank, for pointing the outer end of the blank, and, if desired, for trimming any surplus metal from the end of the blank, whereby all blanks will be uniform in dimension from the underside of the head to the shank shoulder, and from the underside of the head to the end of the bolt. The box tool 292 has the shank 294 thereof suitably se-

cured in the end of a spindle 295 (see Fig. 8) which spindle is rotatably mounted in the slide. Rotation of the spindle may be effected by a bevelled pinion 296, which has a splined connection with a rearward extension 295a of the spindle 295, and the pinion 296 is supported in a convenient manner by a bearing bracket 298, secured to the frame 30 of the machine. A driving connection between the bevelled gear pinion 296 and the crank shaft 34 may comprise a spur gear 299, mounted upon the crank shaft 34 at the right side of the machine, as viewed in Fig. 2, which gear drives a spur gear 300, shown in dotted position in Fig. 2. The spur gear 300 is mounted upon a stud shaft 301, which extends through the side wall of the machine frame portion 31, and mounted upon the inner end of the shaft 301 is a sprocket 302, which is drivingly connected to a pinion sprocket 303. The sprocket 303 is supported by a small stud shaft 304, which supports the bevelled gear 305, the bevelled gear 305 serving to drive the bevelled gear pinion 306. Thus it will be apparent that regardless of the longitudinal motion of the slide 37, the box tool and its supporting spindle will be rotated at all times at the desired metal cutting speed. It will also be apparent that while the extruding action is being effected upon one bolt blank at station A, the pointing action is being effected upon a previously extruded bolt blank simultaneously at station B. Suitable adjusting means may be associated with both the extruding and pointing mechanisms to adapt the machine to different sizes of work.

The extruding die 290 reduces the original diameter of the blanks to the pitch diameter of the threads to be formed thereon. In this way the blanks are prepared for a roll threading operation, during which the metal of the extruded portion is pressed inwardly and caused to flow outwardly by the die impressions so that the resulting overall diameter of the threads equals the diameter of the unextruded portion of the shank. In this way I am able to obtain the advantages of the greater strength and accuracy of roll threads as compared to cut threads, while retaining a uniform overall diameter of the shank portion and thread portion of the resulting bolt.

The roll threading dies are incorporated into the machine and driven in timed relation to the other elements of the machine. The blanks after being extruded and pointed are transferred preferably by a positive gripping transfer to position in front of the roll threading dies and are then fed into these dies in the same consecutive order in which the extruding and pointing operations are carried out. The extrusion die is subject to wear at its throat so that the extruded portions of the shanks of the blanks gradually become larger as the operation of the machine proceeds. By positively maintaining the blanks presented to the roll threading dies in the same consecutive order in which they are acted upon by the extrusion die any increase in size of the extruded portions of the shanks can be accommodated as it occurs by adjustment of the roll threading dies.

It will be understood that a narrow tolerance is allowed for wear of the extrusion die and that when this wear has exceeded the tolerance after the making of a large number of blanks the die is replaced. If the roll threading dies are initially adjusted to receive blanks having the largest diameter within the tolerance range the

threads produced on the blanks of the smallest diameter within this range will not be completely filled up and sharp. Such threads are extremely objectionable in appearance, being ragged on the edges and are also apt to catch or cut anything with which they may come in contact. On the other hand, if the threading dies are adjusted to completely fill out the threads on blanks of the smallest diameter within the tolerance range, a larger diameter blank will be rolled oval because of the excess metal. The threads on these blanks will then not fit the threaded part with which they are to co-operate since the overall diameter of the threads across the major axis of the oval will be excessively large. However, by combining the extrusion die and the threading dies in the same machine the operator may initially adjust the threading dies to receive the smallest diameter blanks within the tolerance range and as soon as a blank is discharged which will not fit the gauge, the roll threading dies may be separated sufficiently, within the tolerance limits, to avoid any oval formation of the threads.

The mechanism for imparting reciprocating movement to the thread forming die slide 51 has been hereinbefore described, and I will now set forth the cooperation of the stationary and moving die blocks, which roll the thread upon the blank as well as the mechanism for effecting the transferring of the bolt blank from station B to station C, and from station C to the thread rolling dies. As hereinbefore stated, no operation is performed upon the bolt blank at station C but the particular place where the gripper fingers engage the bolt blank is changed at station C.

It will be noted in Figs. 5 and 6, and particularly in Fig. 6 that the pairs of fingers 210, 212 and 214 at stations A, B and C, respectively, are all arranged in a common vertical transverse plane so as to be disposed immediately adjacent the outer faces of the chuck jaws, while the fingers 216 are spaced forwardly (note also Fig. 5), whereby the fingers 216 will grip the bolt blank adjacent the outer extruded end of the blank, and when the fingers 216 swing from station C to station D with a bolt blank, the fingers 216 are disposed close to the thread rolling dies 310 and 312. The die 312 is fixed to the slide in any convenient manner and the stationary die is provided with a wedge mounting, as shown in Fig. 2, whereby it may be firmly held in place upon a supporting block 380 by clamp plate 381. Bolts 382 serve to hold the block 380 firmly to the frame 31. Adjusting screws 383, threaded in the machine frame 31, provide means for refinement of adjustment of the die 310 relative to the die 312.

When the fingers 216 are holding the bolt blank in the position shown in Fig. 6, the die block slide 51 is at the uppermost part of its stroke and the bolt is shifted longitudinally to be disposed between the thread rolling dies by an injecting plunger 315. The action of the plunger 315 on the bolt causes the fingers to be spread slightly to remain in engagement with the larger diameter portion of the bolt blank.

I also provide a second means for acting upon the shank of the bolt blank, whereby the bolt blank will be trued up relative to the rolling threads of the die blocks 310 and 312. I accomplish this by a vertically movable member 320, which is operatively supported in a suitable slide-way, whereby the member 320 may be disposed to move at a position between the stationary die

block 310 and the reciprocating die block 312 on the slide 51.

The bolt levelling member 320 may be actuated by a small bifurcated lever 321, suitably pivotally mounted upon a bracket 322, carried by the machine frame, whereby the bifurcated end may engage a pin 323, mounted on the upper end of the bolt levelling member 320. The lever member 321 is secured to a small transversely extending shaft 325, which extends alongside of the slide member 51 and is supported at its inner end by a bracket member 326. A bell crank 327 is attached to the inner end of the shaft 325 and to a vertically extending connecting rod 328, which rod is reciprocated by a lever 329, supported at the top of the machine, whereby the lever 329 may carry a roller 330, which is actuated by a cam 331, the cam 331 being mounted upon the shaft 54 and which shaft carries the gear 53. The shape of the cam 331 is such that the bolt engaging member 320 is actuated through the described mechanism only after the plunger member 315 has injected the bolt to the thread rolling position. Thereafter the Scotch yoke mechanism functions to cause a downward movement of the slide 51 to a lowermost position, indicated by the dot and dash lines 312 in Fig. 2. It will be apparent that when the die block 312 is in the position shown by the dot and dash lines, the bolt is permitted to escape into a chute 340, which will guide the finished bolt to a receptacle 341.

The plunger 315 is spring actuated in a forward direction and to a retractive, inoperative position positively by a cam. The plunger 315 is actuated by a lever 344, suitably mounted upon a pin 345, the pin being attached to the chuck head frame 84 (see Figs. 6 and 9). The lower end of the lever 344 is provided with a roller 346 and the location of the lever 344 is such that the roller 346 will ride against the side of the cam extension 249a of the rack bar 249. This extension 249a of the rack bar is provided with a camming notch, as indicated at 350, whereby the movement of the bar from right to left of Fig. 3 will permit the lever to be actuated by the spring 343, thus causing the plunger rod 315 to act upon the bolt blank to position the bolt blank between the thread rolling die blocks.

The crank shaft 34 is continuously rotating. The longitudinal cam shaft 70 is also continuously rotating by reason of the train gear connection comprising gears 58, 39, 75, transverse shaft 73, and bevel gears 71 and 72. The crank arm 107 on the forward end of the shaft 70, constantly oscillates a pair of hopper members 95 to cause the bolt blanks to be lifted from the hopper 90, head end up, from which the bolts slide downwardly to the raceway members 96. There is no timed relation between the actuation of the hopper and the other mechanisms of the machine, other than that there are sufficient reciprocations or oscillations of the hopper agitator members 94 to always effect the positioning of a greater number of bolt blanks per minute in the raceway 96, than the operating demand of the machine would require.

The work segregator mechanism, shown in Figs. 13 to 18 inclusive, serves to permit the escape of one bolt blank at a time from the raceways and this escapement is effected in timed relation to the other cooperating parts of the machine, by reason of the cam 160 and the separator elements operated thereby. The bolt then drops by gravity to the vertical position shown

in Fig. 7A, and Fig. 13, whereupon the bolt positioning arm 180 is shifted to a position behind the bolt and thereafter swings the bolt to the dot and dash position shown in Figs. 7A and 13.

The four sets of fingers 210, 212, 214, and 216 are then swung simultaneously through an arc, as indicated on Fig. 5, by the actuation of the bar 200, which timed movement is controlled by the relationship of the cam 230 to the cams 160, 183, and 191. Toward the latter part of the arcuate movement of the fingers 210 from left to right of Fig. 5, the lower part of the fingers 210 are brought downwardly into the slot 170a and are forced to spread over the bolt blank as it is held in position by the bolt positioning member 180. There is a slight dwell at this point in the movement of the bar 200 and consequently in the four sets of fingers carried thereby, while the extruding, pointing and thread rolling mechanism are completing the intended operations thereof, whereupon the bar 200 is then swung from right to left, the bolt blank is then presented to the first set of chuck jaws at station A; a repetition of the foregoing movements then causes the bolt blank to remain at station A, while the fingers 210 swing from left to right to pick up another bolt. In the meantime, the fingers 212 will have engaged the bolt blank remaining at station A and will transfer this bolt blank to station B. The chucks are synchronized in their movements with the movements of the fingers whereby the chuck jaws will never be completely open when the fingers are swinging. A second repetition of the foregoing operations will cause the fingers 214 to then transfer the first bolt blank to station C and, as will be obvious, in the meantime the following bolt blanks will be positioned in the chuck jaws at stations A and B. No operation is performed upon the bolt blank at station C. It is there held by the chuck jaws until the forwardly positioned fingers 216 come into engagement with the bolt blank toward the outer extruded end of the bolt blank. A still further cycle of operations will then position the first bolt blank at station D, whereupon the plunger 315 will position the bolt blank forwardly, as shown in Fig. 4. The slide 51 is then operated and when the bolt blank is engaged by the thread rolling die blocks 310 and 312, the bolt blank is snapped downwardly, out of engagement with the fingers 216 but just before the blank is engaged by the thread rolling die blocks, the vertically reciprocating bolt engaging member 320 is caused to come downwardly in timed relation to the movement of the fingers on the bar 200, and the slide 51 to level the bolt should it not be in proper position longitudinally.

From the foregoing description of my invention it will be apparent to those skilled in the art that I provide in a composite machine, groups of coordinated mechanisms, which are adapted to effect the simultaneous performance of operations on work pieces, that the arrangement is adaptable to a variety of operations, which it may be desired to perform upon a piece of work, and that the machine is adaptable to various sizes of work. It will be also apparent to those skilled in the art that the advantages of presenting work, gauging the same relative to thread rolling die blocks which are disposed to operate vertically likewise the work segregator mechanism associated with the hopper adapted to a variety of uses, not necessarily confined to bolt

making, and that the mechanism for transferring a piece of work from one mechanism to another is also adaptable to various mechanical uses in the metal working arts.

5 I claim:

1. In a bolt forming machine, the combination of means to extrude the shank end of a bolt blank, means to point the extruded portion of the bolt blank, adjustable roll threading dies to form a thread on the extruded portion of the bolt blank, and means for successively transferring a series of bolt blanks in the same consecutive order to each of said means, whereby the extruding, pointing and threading operations may be automatically consecutively performed upon each of the series of bolt blanks.

2. In a bolt forming machine, the combination of means to extrude the shank end of a bolt blank, means to point the extruded portion of the bolt blank, adjustable roll threading dies to form a thread on the extruded portion of the bolt blank, means for successively transferring a series of bolt blanks in the same consecutive order to each of said means, and driving mechanisms for actuating all of said means in timed relation.

3. In a bolt forming machine, the combination of means for reducing the diameter of a portion of the shank of a bolt blank by working to flow the metal therein, means to form a convex point upon the bolt blank, adjustable roll threading dies to form a thread on the bolt blank, and means for successively transferring a series of bolt blanks in the same consecutive order to each of said means whereby the reducing, pointing and threading operations may be automatically consecutively performed upon the bolt blanks.

4. In a machine of the character described, the combination of a plurality of reciprocating mechanisms each of which effects a different operation on a piece of work, said mechanisms including a thread rolling mechanism, non-rotating work holding chucks co-acting with a plurality of said mechanisms for holding the work rigid while said mechanisms act thereon, and work transferring means coacting with said mechanisms and chucks for transferring a plurality of work pieces from chuck to chuck, means co-ordinating the operation of said mechanisms, chucks, and transferring means and means for injecting a work piece into the thread rolling mechanism from the transferring means.

5. In a machine of the character described, the combination of a plurality of reciprocating mechanisms each of which effects a different operation on a piece of work and including an extruding mechanism, a turning cut mechanism and a thread rolling mechanism, a work holding chuck co-operating with said turning mechanism for holding the work rigid while said mechanism acts thereon, a work transferring means cooperating with said mechanisms for simultaneously transferring a plurality of work pieces from station to station, means coordinating the operation of said mechanisms, and transferring means, and a second work transferring mechanism for finally presenting the extruded and turned piece of work to the thread rolling mechanism.

6. In a machine of the character described, the combination of an extruding mechanism adapted to effect a diameter reducing operation on a round piece of work, a chuck cooperating with said extruding mechanism for holding the work piece

stationary while the work piece is being extruded, means for opening and closing said chuck, a second mechanism for pointing the extruded part of the work including a second chuck, a plurality of work gripper means positioned to grip the work in front of said chucks and operated in unison to transfer work pieces from chuck to chuck, a third chuck at an idle position and arranged to receive work transferred from the second-named chuck, a thread rolling mechanism, a work gripper for transferring the work from said last-named chuck to a position in alignment with said thread rolling means, means to move said work longitudinally in said last-named work gripper into the path of the thread rolling means, and means for actuating said chuck operating means, said mechanisms and said gripper means in timed relation, whereby said operations may be effected upon the work pieces automatically in sequence.

7. In a machine of the character described, the combination of means for reducing the diameter of a piece of work, means for pointing said reduced portion of the work, means for positioning the work in a longitudinally adjusted manner relative to each of said means, means for holding the work after being thus positioned, a common support on which said reducing means and said trimming means are mounted for movement towards and from said workholding means, means to move said reducing means and said trimming means, said trimming means being also rotatably mounted in said support, means to rotate said trimming means, a work transferring device for shifting the work from one to the other of said reducing and trimming means, and a plurality of motion transmitting mechanisms for operating all of said means and said device in timed relation, whereby said operations on the work may be successively performed.

8. In a machine of the character described the combination of a series of chucks adapted to hold a bolt blank while the same is being worked upon, said chucks being equidistantly mounted upon an adjustable head, a means cooperating with each chuck for performing an operation on the bolt blank, means on said head for adjusting the position of the bolt blank while in the chucks, and means for transferring the bolt blank from chuck to chuck sequentially.

9. In a metal working machine, a plurality of fabricating mechanisms, a work holding head provided with a separate chuck for each of said mechanisms, said head being adjustable to and from said mechanisms for adaptation to the holding of work blanks of different lengths, a work transferring mechanism adapted to transfer a piece of work from chuck to chuck, whereby sequential operations may be performed upon the work by said mechanisms, said head including means for positioning a work piece longitudinally after the work piece is placed in the chuck, and a longitudinal thrust absorbing means for backing up the work pieces held in the chucks in longitudinal direction, whereby longitudinal strains created by the operation of said mechanisms upon the work pieces will be transmitted through the head to the machine frame and thereby protect the operating members of the work head from excessive strain.

10. In a metal working machine, a plurality of mechanisms, a work holding head provided with a separate chuck for each of said mechanisms, a work transferring mechanism adapted to transfer a piece of work from chuck to chuck, where-

by sequential operations may be performed upon the work by said mechanisms, and a longitudinal thrust absorbing means for backing up the work pieces in the chucks in longitudinal direction, whereby longitudinal strains created by the operation of said mechanisms upon the work pieces will be transmitted through the head to the machine frame and thereby protecting the operating members of the work head from excessive strain.

11. In a metal working machine, a plurality of mechanisms, a work holding head provided with a separate chuck for each of said mechanisms, a work transferring mechanism adapted to transfer a piece of work from chuck to chuck, means for positioning work pieces longitudinally after the work pieces are placed in the chucks and a longitudinal thrust absorbing means for gauging the work pieces and for backing up the work pieces in the chucks in longitudinal direction.

12. In a metal cutting machine, a frame, a pair of slides each mounted in said frame for reciprocation movement toward and away from each other, a plurality of workholders carried by one slide, means to manually position said workholder slide, means to transfer workpieces from one workholder to another, a series of mechanisms carried by the other slide and arranged to operate on work carried by opposing workholders, means to reciprocate said last-named slide to cause said mechanism to coast with work carried by said workholders, and means to operate said work transferring mechanism in timed relationship with said last-named slide.

13. In a metal cutting machine, a frame, a pair of slides each mounted in said frame for reciprocation movement toward and away from each other, a plurality of workholders carried by one slide, transfer means carried by said last-named slide to transfer work from one workholder to another sequentially, means to manually position said workholder slide, a series of mechanisms carried by the other slide and arranged to operate simultaneously on work carried by opposing workholders, one of said mechanisms including a member rotatable in said slide, means to reciprocate said last-named slide a predetermined distance to cause said mechanism to coast with work carried by said workholders, and means to rotate said rotatable mechanism.

14. In a metal working machine, a main frame, a series of chucks adapted to hold bolt blanks, a common support for said chucks, a guideway in which said support is mounted for movement in a direction parallel with the axis of the blanks, means to secure the support in an adjusted position in said guideway whereby all of said chucks may be simultaneously moved to position them for holding work blanks of different length, means movably carried by the frame and coasting with respective chucks for performing operations on the blank, means to move said last-named means intermittently toward and away from said chucks, and means to transfer the blanks from chuck to chuck sequentially when the operating means is away from their respective chucks.

15. In a metal working machine, a main frame, a series of chucks adapted to hold bolt blanks, a common support for said chucks, a guideway in which said support is mounted for movement in a direction parallel with the axis of the blanks, means to clamp the support in adjusted position in said guideway whereby all of said chucks may be simultaneously moved to position them for holding work blanks of different length, means

carried by and movable with said support to transfer the blanks from chuck to chuck sequentially, means movably carried by the frame and coasting with respective chucks for performing operations on the blank, means to move said last-named means intermittently toward and away from said chucks in timed relationship with said transfer means.

16. In a metal working machine a main frame, a series of chucks adapted to hold bolt blanks, a common support for said chucks mounted for sliding movement in said frame in a direction parallel with the axis of the blanks, manually operable means to move said support to adjust the chucks for bolt blanks of different lengths, independent means coasting with the blanks in each chuck to position the blanks relative to their respective chucks, a second support mounted in said frame for reciprocatory movement toward and away from said chucks, a blank extruding mechanism carried by said last-named support, a blank pointing mechanism rotatably mounted in said support, means to rotate said pointing mechanism, means to reciprocate said last-named support, and a work transferring mechanism acting in timed relationship with said last-named means to transfer blanks from chuck to chuck in sequence.

17. In a metal working machine, a main frame, a series of chucks adapted to hold headed bolt blanks, a common support for said chucks, a guideway in which said support is mounted for movement in a direction parallel with the axis of the blanks, means to clamp the support in adjusted position in said guideway whereby all of said chucks may be simultaneously moved to position them for holding work blanks of different length, positioning means carried by the frame to force the head of the blanks against a face of their respective chucks, means movably carried by the frame and coasting with respective chucks for performing operations on the blank while said last-named means is in contact with the blank, operating means to move said positioning and said operating means intermittently toward and away from said chucks, and means to transfer the blanks from chuck to chuck sequentially when both of said last-named means are away from their respective chucks.

18. In a bolt machine, an extrusion die, means for presenting bolt blanks in sequence into alignment with said die, means for producing relative reciprocation of a blank and said die to extrude a portion of the length of each blank to a smaller diameter, a pair of reciprocating roll threading dies adjustable toward and away from each other to roll threads on shanks of different diameter, and means for transferring the extruded blanks to said threading dies in the same consecutive order in which the blanks are acted on by said extrusion die and in position to have threads rolled on the extruded portions.

19. In a bolt machine, an extrusion die, means for presenting bolt blanks in sequence into alignment with said die, means for producing relative reciprocation of a blank and said die to extrude a portion of the length of each blank to a smaller diameter, a pair of reciprocating roll threading dies adjustable toward and away from each other to roll threads on shanks of different diameter, means for transferring the extruded blanks to said threading dies in the same consecutive order in which the blanks are acted on by said extrusion die and in position to have threads rolled on the extruded portions, and means for operating

said reciprocating means, said roll threading dies and said transfer means in synchronism so as to produce an extruded and threaded blank during each cycle of the machine.

20. In a bolt machine, means for extruding the shanks of blanks, means for presenting a series of blanks to said extruding means in consecutive order, a pointer for pointing the shanks of the extruded blanks, means for transferring the blanks acted upon by said extrusion means to said pointer in the same consecutive order, a pair of co-operating roll threading dies adjustable toward and away from each other to roll threads on shanks of different diameter, and means for transferring the blanks acted on by said pointer to said threading dies in the same consecutive order and in position to have threads rolled on the extruded portions.

21. In a bolt machine, means for extruding the shanks of blanks, means for presenting a series of blanks to said extruding means in consecutive order, a pointer for pointing the shanks of the extruded blanks, means for transferring the blanks acted upon by said extrusion means to said pointer in the same consecutive order, a pair of co-operating roll threading dies adjustable toward and away from each other to roll threads on shanks of different diameter, means for transferring the blanks acted on by said pointer to said threading dies in the same consecutive order and in position to have threads rolled on the extruded portions, and means for operating said extrusion means, said pointer, said roll threader and said transfer means in synchronism.

22. In a bolt machine, a main frame, a reciprocating slide, a work station comprising co-operating tools carried by said frame and said slide, a pair of reciprocating roll threading dies, means for presenting blanks in sequence to said work station and means for grasping the blanks acted upon by said tools at said work station and carrying the same into position to be fed into said roll threading dies.

23. In a bolt machine, a main frame, a reciprocating slide, a work station comprising co-operating tools carried by said frame and said slide, a pair of reciprocating roll threading dies, means for presenting blanks in sequence to said work station, means for grasping the blanks acted upon at said work station and carrying the same laterally to an idle position, and means for grasping the blanks from said idle position and carrying the same into position to be fed into said roll threading dies.

24. In a bolt machine, extruding mechanism for reducing the diameter of a portion of the shank of a blank, means for presenting a blank into position to be acted upon by said extruding mechanism, a pair of cooperating roll threading dies, and means for transferring a blank acted upon by said extruding mechanism to said roll threading dies and rolling a thread thereon while maintaining said blank at all times in a position parallel to the first mentioned position.

25. In a bolt machine, a main frame, a reciprocating slide mounted therein, means on said frame for positioning and holding a blank in position relative to the frame, and an extrusion die on said slide arranged to be driven over the blank to extrude the same into the die.

26. In a bolt machine, a plurality of aligned work stations, cooperating tools at each of said work stations, means for presenting blanks in sequence to the first of said stations, means for transferring said blanks from one station to the

next, a pair of reciprocating roll threading dies, means for grasping said blanks at the last of said stations and carrying the same to said roll threading dies, and means for feeding the blanks consecutively from said grasping means into said dies.

27. Apparatus for performing a plurality of operations upon bolt blanks including a work station comprising cooperating tools for acting upon a blank in a horizontal position, a pair of cooperating roll threading dies arranged for relative reciprocation in a vertical direction, and means for transferring blanks from said work station and for positioning the same in a horizontal starting position with respect to said dies.

28. Apparatus for performing a plurality of operations upon bolt blanks including a work station comprising cooperating tools for acting upon a blank in a horizontal position, a pair of cooperating roll threading dies arranged for relative reciprocation in a vertical direction, means for transferring a blank from said work station and positioning the same horizontally in alignment with said dies, and means for moving said blank axially into position between said dies.

29. In a bolt machine, a main frame, a reciprocating slide, a work station comprising cooperating tools carried by said frame and said slide, a pair of reciprocating roll threading dies, means for presenting blanks in sequence to said work station, means for grasping the blanks acted upon at said work station and carrying the same laterally to an idle position, means for transferring the blanks from said idle position into starting position with respect to said roll threading dies and means for pushing the blanks from said starting position into engagement with said dies in the same consecutive order in which said blanks are acted upon at said work station.

30. Apparatus for performing a plurality of operations upon bolt blanks comprising a holding chuck for grasping a bolt blank by the head to position the blank and hold the same, a cutting tool for pointing the end of the blank, said pointing tool and said chuck being relatively reciprocable to bring the tool into engagement with the end of the blank and being relatively rotatable, a pair of reciprocating roll threading dies, means for presenting blanks in sequence to said chuck, means for transferring blanks directly from said chuck to a starting position with respect to said roll threading dies without intermediate handling, means for individually starting said blanks between said roll threading dies in the same consecutive order in which the blanks are acted upon by said pointing tool, and driving means for driving said roll threading dies and reciprocating means in synchronism so as to point one blank and roll a thread on another blank during each cycle of the machine.

31. The method of making a series of bolts including consecutively extruding the shanks of a series of bolt blanks, transferring the extruded bolt blanks to a roll threading mechanism and rolling threads upon the extruded shanks in the same consecutive order in which the blanks are extruded.

32. The method of making a series of bolts including consecutively extruding the shanks of a series of bolt blanks, and rolling threads upon the extruded shanks in the same consecutive order in which the bolt blanks are extruded and with substantially the same lapse of time between the extruding and thread rolling operations on each of the series of blanks.

33. The method of making a series of bolts comprising extruding a series of bolt blanks consecutively, roll threading the bolt blanks in the same consecutive order as extruded, and adjusting the roll threading dies at intervals to compensate for wear of the extrusion die.

34. The method of making a series of bolts comprising extruding a series of bolt blanks, roll threading the bolt blanks in the same consecutive order as extruded, and increasing the spacing of the roll threading dies at intervals to compensate for increased diameter of the extruded portions of the bolt blanks resulting from wear of the extrusion die.

35. The method of making a series of bolts comprising successively extruding a series of bolt blanks, pointing the series of extruded bolt blanks in the same consecutive order as extruded, and roll threading the series of bolt blanks in the same consecutive order as extruded and pointed and increasing the distance between the roll threading dies at intervals to compensate for the increased diameter of the extruded portions of the bolt blanks resulting from wear in the extrusion dies.

36. The method of making a series of bolts comprising extruding a series of bolt blanks in a horizontal position, advancing the bolt blanks horizontally between a pair of reciprocating roll threading dies, and rolling threads on the extruded bolt blanks while horizontally disposed in the same consecutive order as extruded.

37. The method of making bolts comprising the clamping of a headed bolt blank adjacent its head, extruding a portion of the bolt blank by relative axial movement between the bolt blank and an extrusion die, and removing the bolt blank from the die by pulling axially upon the die and headed end of the bolt blank.

38. In a machine having a bed frame and a header slide, the combination of a plurality of work stations to successively perform different fabricating operations upon a blank, a transfer mechanism to move a blank from one station to the next succeeding station comprising spring pressed gripping fingers to engage a blank, pivoted jaw means arranged below said fingers to supplement the gripping action of said spring pressed fingers when disposed in alignment with one of said work stations.

39. In a bolt forming machine the combination of means to extrude and point the shank end of a bolt blank, adjustable roll threading dies to form a thread on the extruded portion of the bolt blank, and means for successively transferring a series of bolt blanks in the same consecutive order to each of said means whereby the extruding, pointing and threading may be automatically consecutively performed upon each of the series of bolt blanks.

40. Bolt finishing apparatus comprising a frame, a slide reciprocably mounted in said frame, tool means carried by said slide and frame for acting upon bolt blanks including an extrusion die for extruding the shanks of the bolt blanks, means for presenting headed bolt blanks to said tool means in consecutive order, a pointing mechanism comprising a chuck for gripping and hold-

ing a blank, and a cutting tool, said chuck and cutting tool being relatively rotatable and relatively reciprocable in timed relation to the reciprocation of said slide, and means for transferring the blanks acted on by said tool means to said pointing mechanism in the same consecutive order as acted upon by said tool means.

41. Bolt making apparatus comprising a frame, a slide reciprocably mounted in said frame, tool means carried by said slide and frame for acting upon bolt blanks including an extrusion die for extruding the shanks of the bolt blanks, means for presenting bolt blanks to said tool means in consecutive order, a pointing mechanism comprising a chuck for gripping and holding a blank, and a cutting tool, said chuck and cutting tool being relatively rotatable and relatively reciprocable in timed relation to the reciprocation of said slide and means for transferring the blanks acted on by said tool means to said pointing mechanism in the same consecutive order as acted upon by said tool means.

42. A mechanism for acting upon bolt blanks comprising a main frame, a slide reciprocably mounted in said frame, means for reciprocating said slide, tool means carried by said slide and cooperating tool means carried by the frame and arranged to perform a pressure operation upon bolt blanks when said slide is reciprocated, one of said tool means constituting a holder for the blanks while they are being worked, means for presenting bolt blanks to said tool means, a pointing mechanism comprising a chuck for gripping and holding bolt blanks, a cutting tool for cutting a point upon the end of a blank held by said chuck, said chuck and cutting tool being relatively reciprocable to bring a blank held by the chuck into engagement with the cutting tool, and said chuck and cutting tool being relatively rotatable to cut the point, and means for removing the blanks acted on by said tool means from said holder and transferring the same to said pointing mechanism in the same consecutive order in which the blanks are acted on by said tool means, said pointing mechanism being timed with said reciprocating slide to point a blank during each cycle of movement of said slide and said removing and transferring means being timed with respect to said reciprocating slide to present a blank to said pointing mechanism during each cycle of the movement of said slide.

43. In a bolt machine, a bed frame, a reciprocating header slide, co-operating tools on said bed frame and said header slide to extrude the shank of a bolt blank, a pointing mechanism comprising a chuck member to grip the extruded blank and a cutter member to cut a point at the end of the extruded blank, said members being relatively rotatable, one of said members fixed with respect to said bed frame and the other member reciprocable with respect thereto, and means to transfer a blank extruded by said tools to said pointer, said means operating in timed relation to said header slide and pointing mechanism to effect successive extruding and pointing of the blanks.

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