April 1, 1952 C. D. OVERLY 2,591,285

BOLT FINISHING MACHINE

Filed March 29, 1946 7 Sheets-Sheet 1

Fig. I.

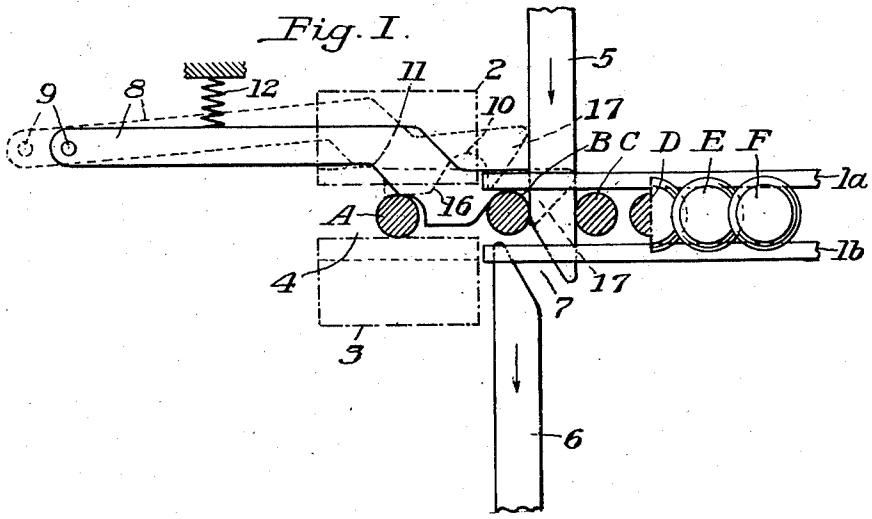
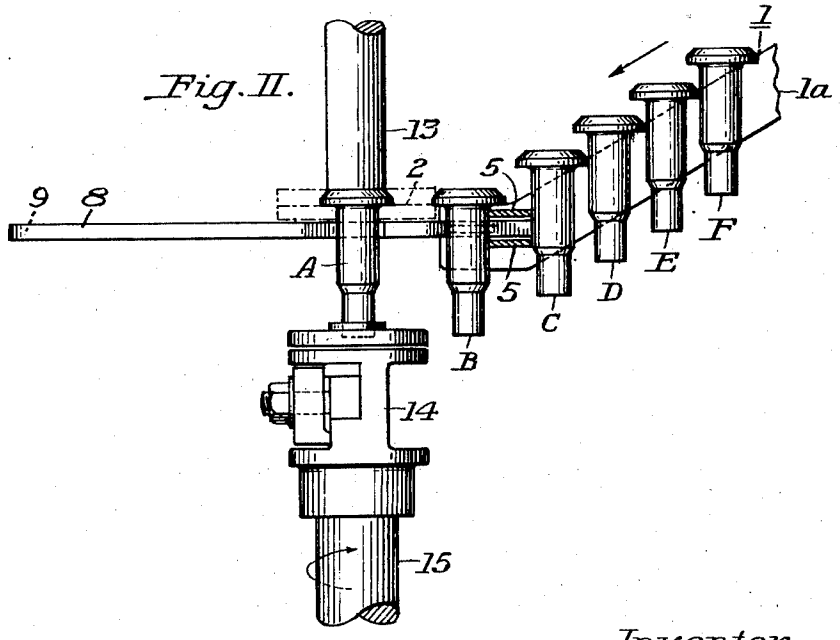


Fig. II.



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BOLT FINISHING MACHINE

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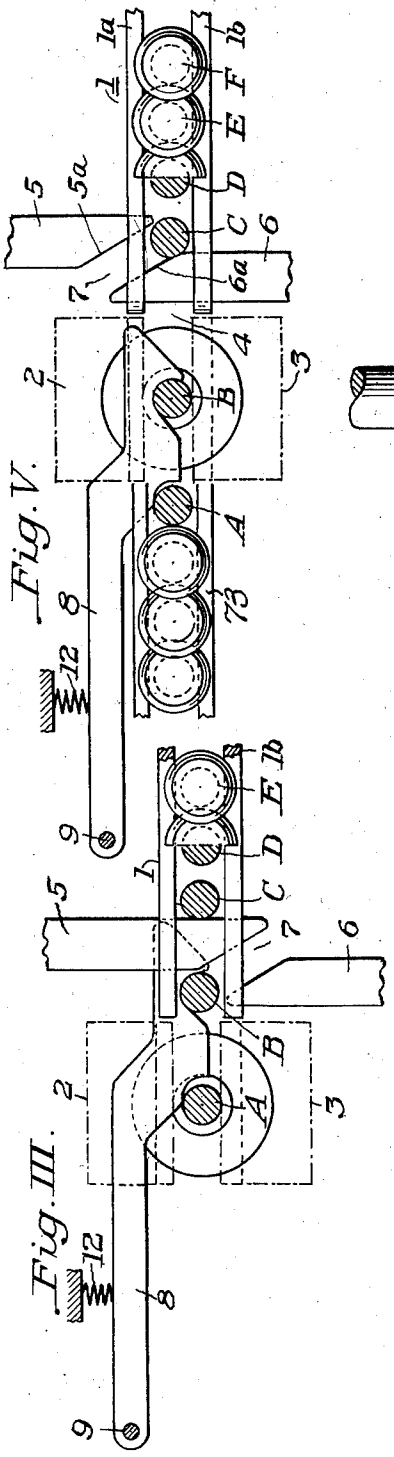


Fig. V.

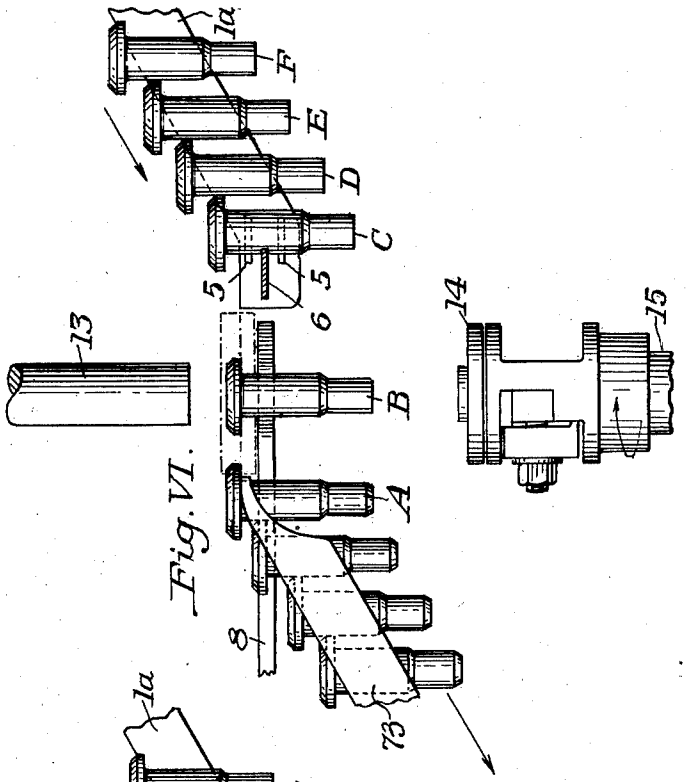


Fig. VI.

Fig. III.

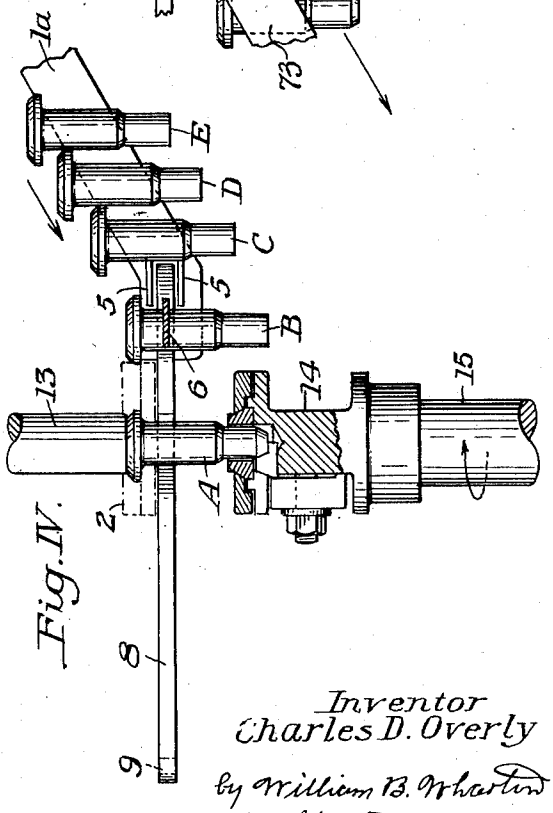


Fig. IV.

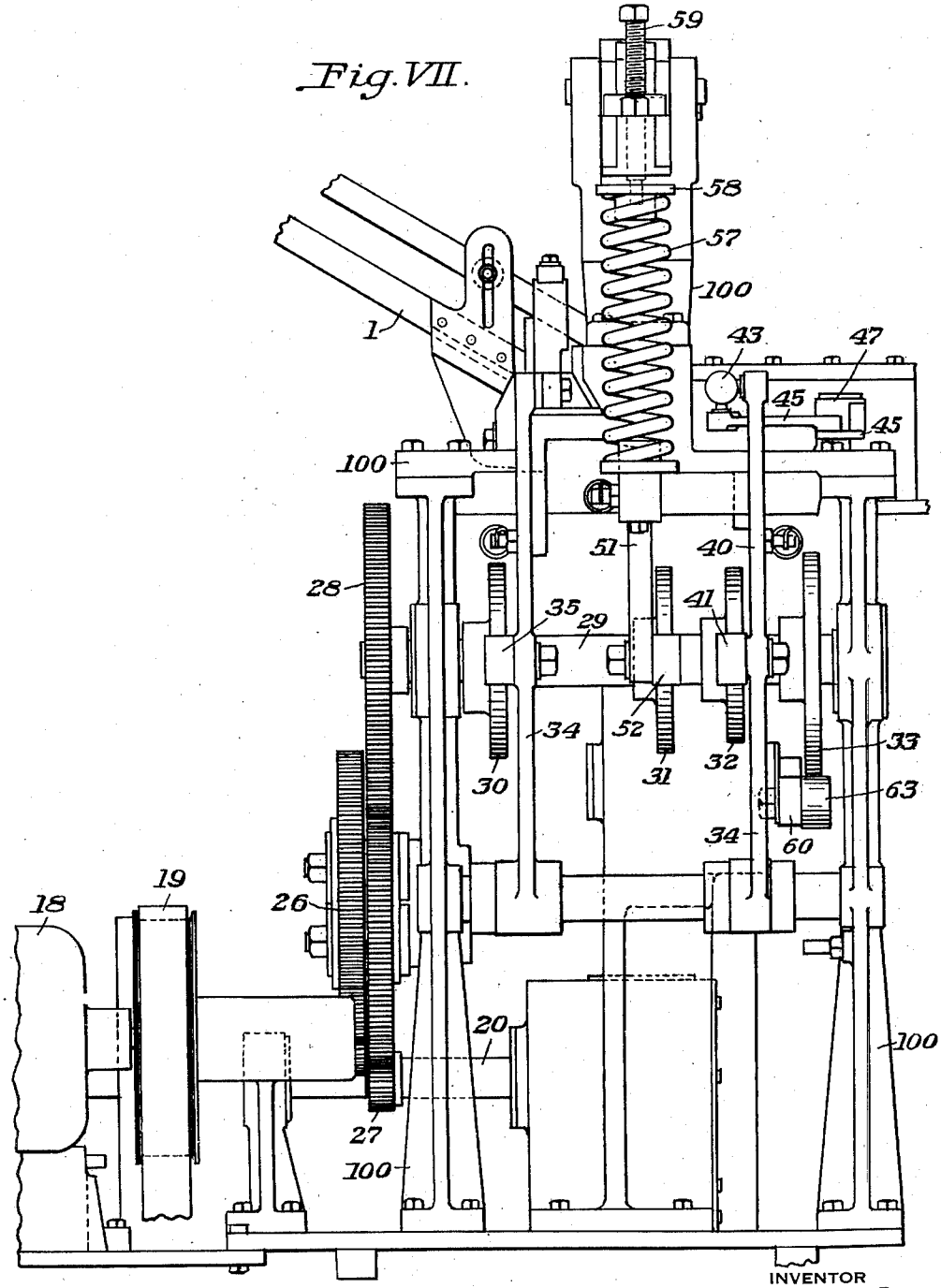
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BOLT FINISHING MACHINE

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Fig. VII.



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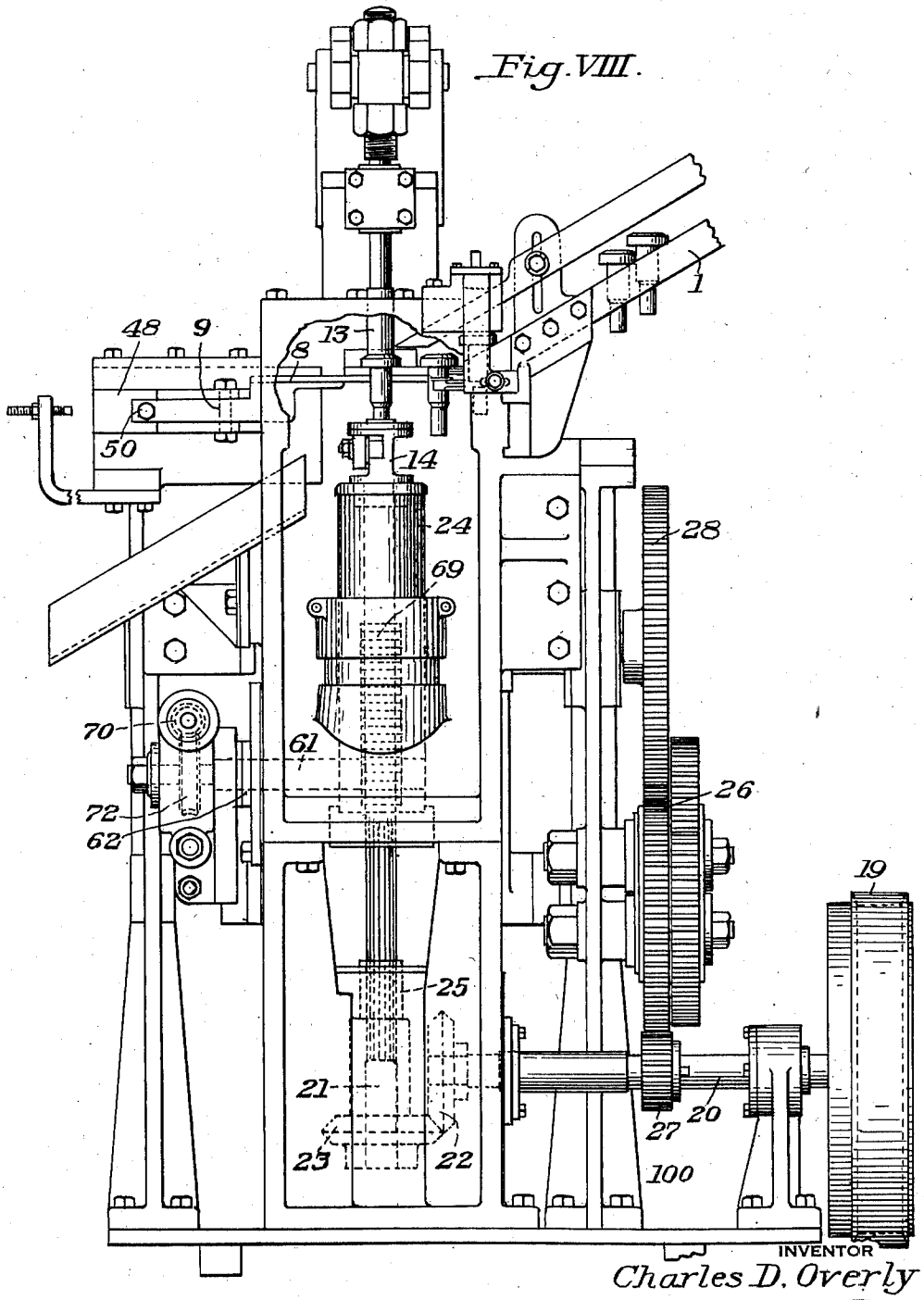
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BOLT FINISHING MACHINE

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Fig. VIII.



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BOLT FINISHING MACHINE

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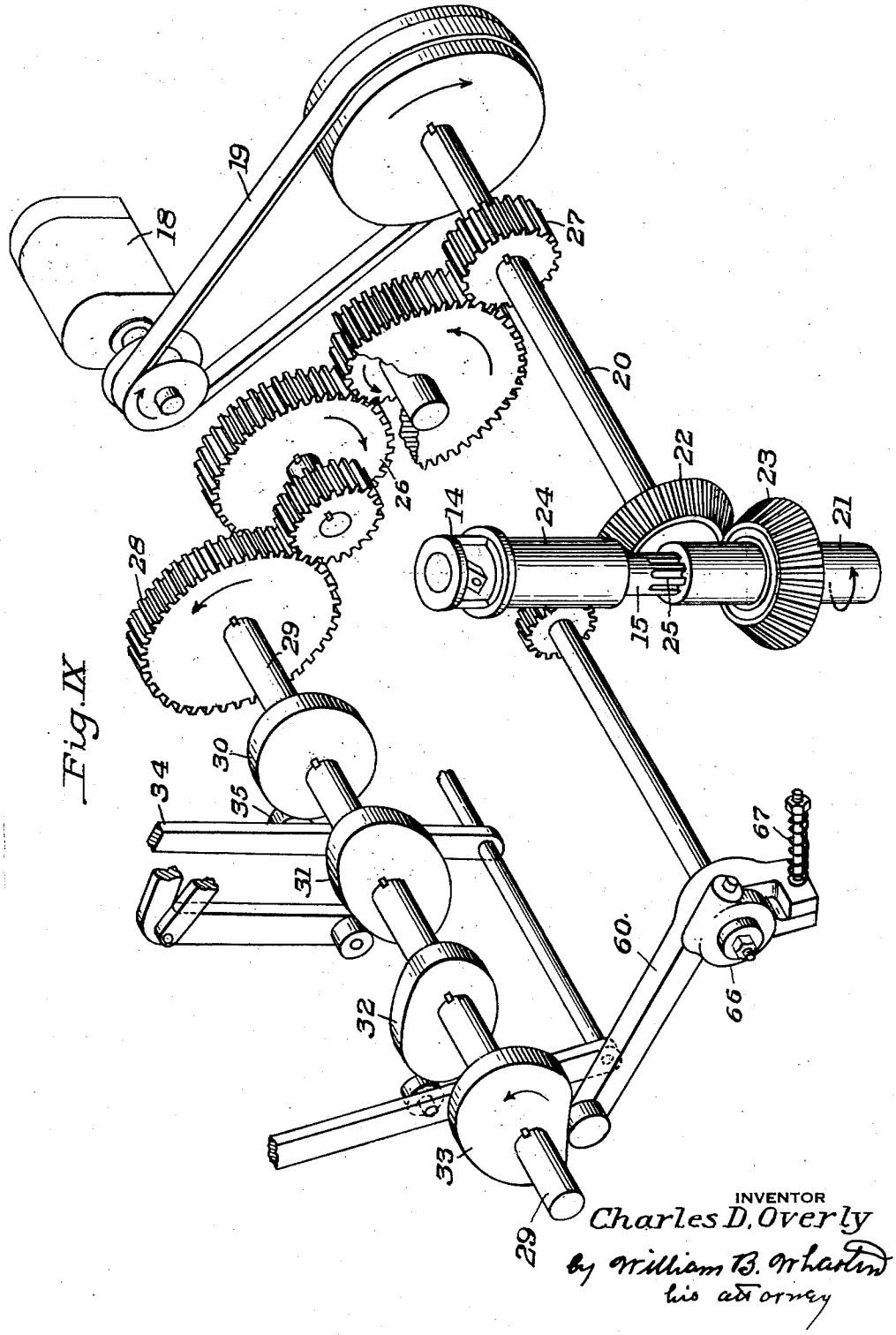


Fig. IX

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BOLT FINISHING MACHINE

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Fig. X.

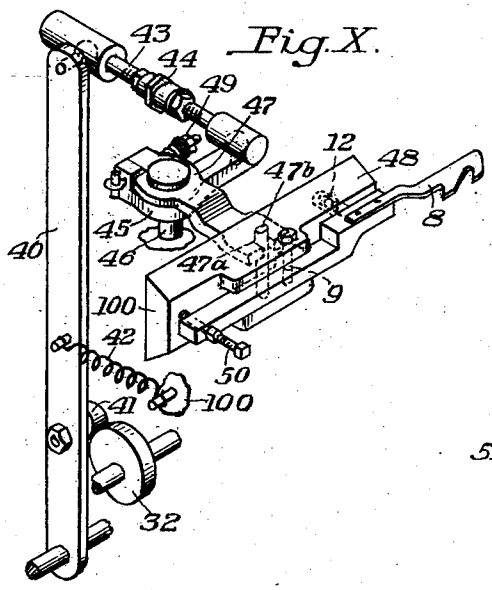


Fig. XII.

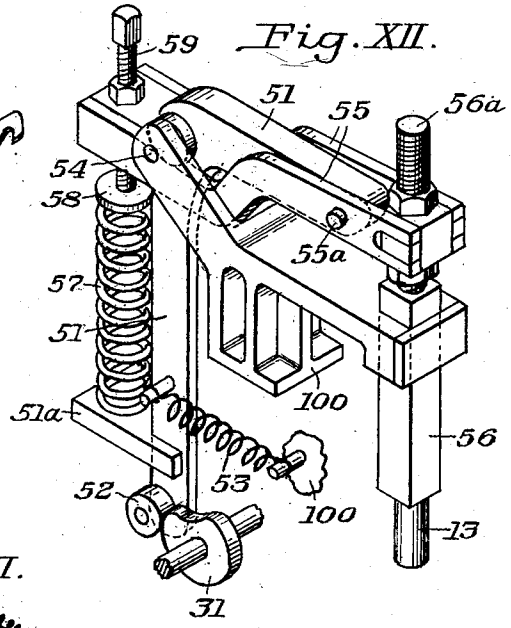


Fig. XI.

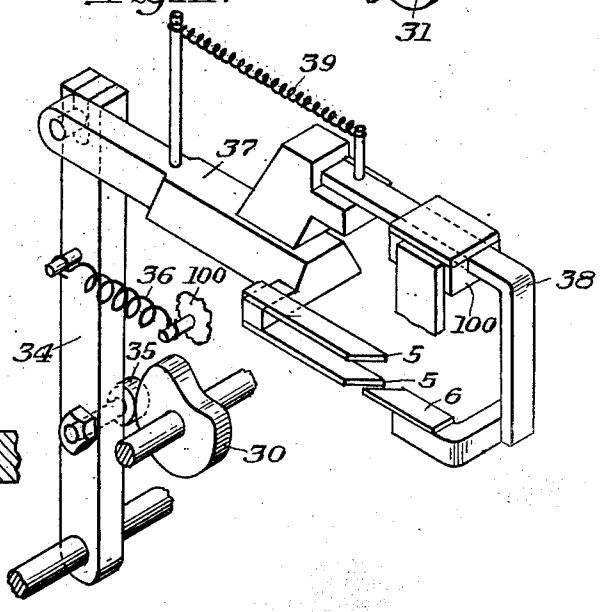
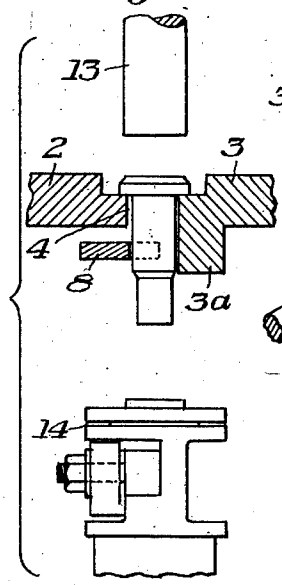


Fig. Xa



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BOLT FINISHING MACHINE

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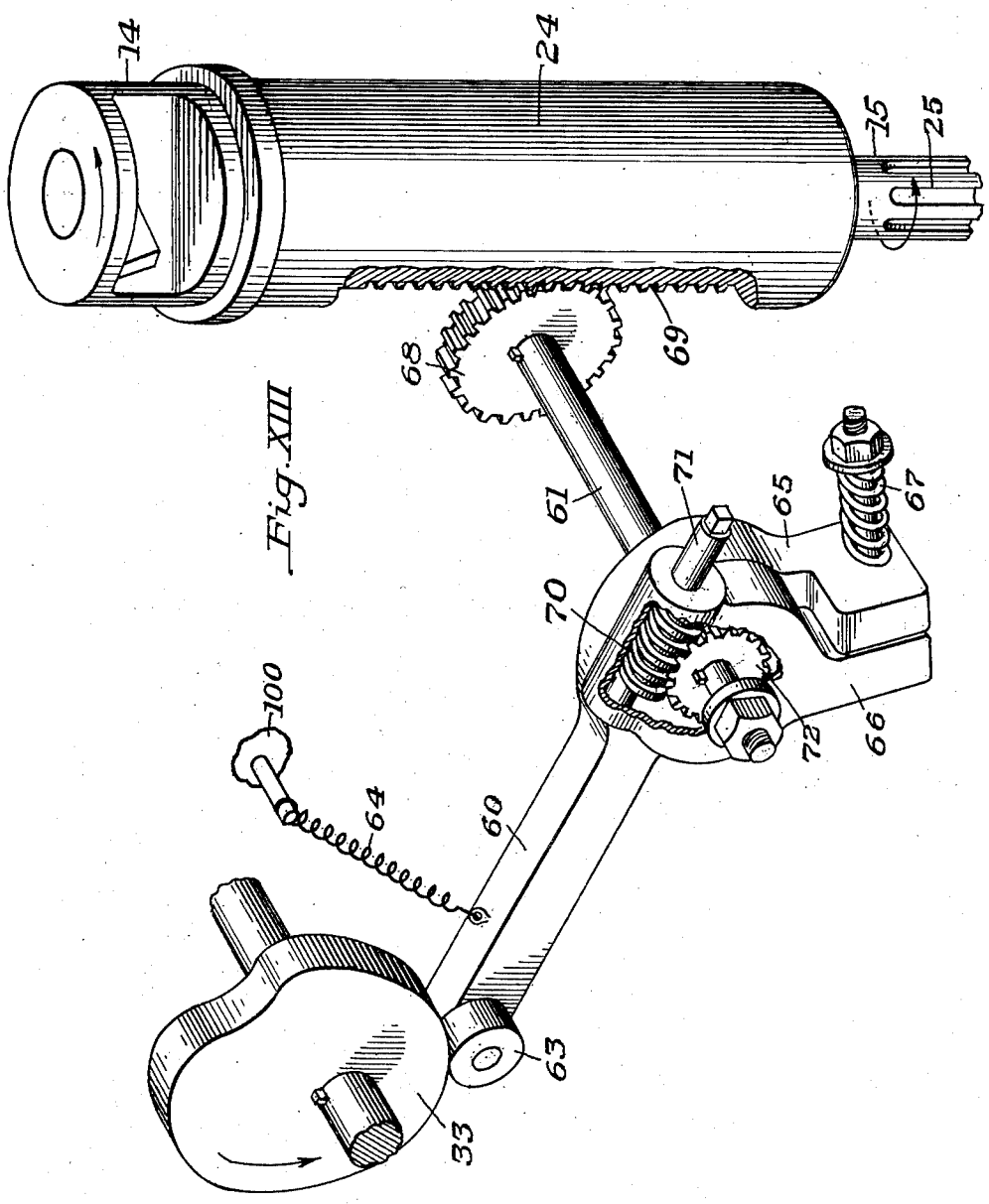


Fig. XIII

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UNITED STATES PATENT OFFICE

2,591,285

BOLT FINISHING MACHINE

Charles D. Overly, Pittsburgh, Pa., assignor to Oliver Iron and Steel Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Application March 29, 1946, Serial No. 658,122

5 Claims. (Cl. 10—21)

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This invention relates to a bolt finishing machine.

In its organization the bolt finishing machine of this invention is adapted to the performance of a variety of cutting or other finishing operations on bolts, screws and similar metal work-pieces which comprise a head and shank. Among such operations are pointing the bolt shank, threading the shank, and a turning operation such as that performed in preparing the shank of a bolt blank for the addition of a rolled thread.

Primary objects of the invention are to provide a bolt finishing machine in which the operation is accurate and rapid, which is adapted to a variety of finishing operations, which securely holds the bolt or similar blank for the finishing operation, and which is adaptable to bolts and similar articles presenting a wide range in the relative proportioning between the diameter and length of their shanks.

More specific objects of the invention are to provide a finishing machine for bolt blanks and similar headed blanks which receives the blanks, performs a cutting operation on them and discharges the products of the operation, all in upright position of the blanks and products, and which holds the blank being cut firmly against the thrust and torque of the cutting tool by vertically directed pressure.

It is another specific object of the invention to provide feeding means for the bolt blanks so timed with the holding and cutting means of the machine that there is no appreciable rest period in its operation, the entire sequence of steps involving the feeding, holding and cutting of the blanks being performed without any appreciable interval interposed by a substantial rest period of the feeding instrumentalities.

Another specific object of the invention is to provide a bolt finishing machine which is organized for simple and accurate adjustment to the size of the work-pieces, and which involves effective safety means to prevent jamming of the machine by an irregularity in the size or formation of the work-piece.

In accordance with the illustrated embodiment of my invention headed blanks, such as bolt blanks, are fed in a position in which they are suspended from their heads, as by gravity feed down an inclined feed-way. At the base of the feed-way the proximate bolt is separated from the line of bolts being fed by an escapement, and succeeding bolts are momentarily detained. The proximate bolt which has been separated out is engaged by a feed-finger and is moved along a

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guide slot still in suspended position to the point at which the cutting operation, or other finishing operation, takes place. This point, which may be considered the working station of the machine, is in the guide slot which forms a continuation of the feed-way. At that point it is held firmly by pressure directed downwardly on its head by a pressure foot, which thrusts the under surface of the head downwardly against the supporting surface of the blocks or anvil members defining the guide slot through which the shank of the bolt extends. This downwardly extended shank which is so held is acted on by a working head (specifically as shown comprising a pointing tool) which rises into operative position from beneath the lower end of the shank. During the cutting operation the feed-finger moves forwardly toward the escapement mechanism, past the bolt which is being held and cut, into a gathering position in which it engages both that bolt and the next successive bolt which in the meanwhile has been separated out by an escapement. With the shanks of both of these two bolts engaged, the feed-finger moves rearwardly from its gathering position, discharging the bolt the shank of which has been pointed, and bringing a fresh bolt along the guide slot into position to be held by the pressure foot and acted on by the cutting tool.

The above explanation has been made with respect specifically to bolts for the sake of simplicity of expression. In such explanation and hereinafter throughout the specification and claims it is, however, to be understood that the word "bolt" is used illustratively and not exclusively, and that it is to be understood as illustrative of a wide variety of analogous blanks, or work-pieces, which comprise a head and shank and which may be tubular as well as solid, and the shanks of which may for some finishing operations be of a form other than cylindrical.

Specifically as shown, these several instrumentalities are operated in timed relation by connections to a plurality of cams, which cams are mounted on a common cam-shaft, and which connections comprise adjusting means and safety means for preventing injury to the mechanism by jamming. In the organization the stroke of the several operating elements is adjustable without altering the relative position or shape of the cams, and the timing of the machine is in accordance with the relative design of the several cams, the design of which for proper timed relation of the operating elements is within the ability of a skilled cam designer.

In the accompanying drawings illustrative of the above noted specific embodiment of my invention:

Fig. I is a schematic view primarily in plan showing the proximate end of the feed-way of the machine, the guide slot for the bolt blanks, the blades of the escapement mechanism, and the feed-finger, this view being partially in horizontal section through the bolts to show elements lying beneath the bolt heads, and showing the position of the elements during the cutting operation on one bolt blank and as the feed-finger moves forwardly into its gathering position in which it engages both the next succeeding blank and the blank which is undergoing the cutting operation.

Fig. II is a side elevation of the elements shown in Fig. I, with the addition of the pressure foot and cutting tool of the organization, showing the elements of Fig. I in the same relation shown in that figure.

Fig. III is a schematic view primarily in plan, showing the same elements that are shown in Fig. I, but illustrating a position of those elements in which the feed-finger has moved forwardly, or to the right of the drawings, into a position of engagement with the bolt which is undergoing the cutting operation, and the next successive bolt in preparation for its return discharging and positioning stroke.

Fig. IV is a side elevation analogous to Fig. II, but showing the operating elements in the position illustrated in Fig. III.

Fig. V is a schematic view primarily in plan analogous to Figs. I and III, but showing a bolt blank which has been subjected to the cutting operation removed from cutting position into discharging position and the successive bolt which is shown engaged in Fig. III moved into cutting position by action of the feed-finger, and showing also the escapement mechanism of the organization in its selecting position in which it has separated out the proximate bolt which is to be brought into position for engagement by the feed-finger.

Fig. VI is a view analogous to Figs. II and IV, but showing the elements in the position in which they are shown in Fig. V, and showing also both the pressure foot and the cutter head retracted vertically in opposite directions, to permit discharge of the blank which has been cut and prior to their advancement into position for holding and cutting the blank which has just been brought into cutting position.

Fig. VII is a rear elevation of the entire bolt finishing machine.

Fig. VIII is a front elevation of the machine.

Fig. IX is a perspective schematic view showing the four operating and control cams of the machine, together with the spindle which carries the cutting head, connections for rotating the spindle and connections for vertically advancing and retracting the cutter head.

Fig. X is a detail perspective view of somewhat schematic sort showing the feed-finger and the operating connections for producing movement thereof.

Fig. X*a* is an end elevation of the guiding and work-piece-supporting structure associated with the feed-finger, looking from the left in Fig. VIII and showing the feed-finger in cross-section.

Fig. XI is a similar view of the operating connections for the escapement mechanism of the organization.

Fig. XII is a similar view of the operating connections for the pressure foot.

Fig. XIII is an enlarged perspective schematic

view, showing the connections for advancing and retracting the cutter head of the machine, and showing those connections regionally broken away to expose means for adjusting the position of the cutter head to which it is retracted and from which it is advanced into operative relation with the work.

Referring to the drawings above described, and particularly to the illustrative showing of Figs. I to VI inclusive, the bolt blanks appearing in Figs. I and II of the drawings are designated by sequential letters of reference A, B, C, D, E, and F, and those same designations are followed throughout other figures of the drawings. In the drawings reference numeral 1 designates an inclined portion of a feed-way, or slide, down which the bolt blanks pass by gravity, with their shanks extended downwardly between the rails forming the feed-way, and with the under surface of their heads resting on the upper surfaces of the rails. At the base of the slide the bolt-way 1 formed by rails 1*a* and 1*b* is continued by spaced guide or anvil blocks 2 and 3, which define between them a guide slot 4. The escapement mechanism of the machine by which bolt blanks are presented one at a time for positioning and cutting comprises as its bolt-contacting elements a pair of blades 5 mounted together in vertically spaced relation, and an opposed blade 6 mounted in opposition to the blades 5. The adjacent edges of blade 6 and the opposed pair of blades 5 are oppositely chamfered at 6*a* and 5*a* respectively, to form an inclined passage 7 therebetween.

The feed-finger is designated generally by reference numeral 8, and has a pivoted mounting 9 on a suitable member, which reciprocates along a path paralel to guide slot 4. In one lateral face of feed-finger 8 there are a forward bolt-engaging notch 10 and a rearward bolt-engaging notch 11. A coil spring 12 attached to the reciprocating member on which guide finger 8 is mounted tends to hold the guide finger in a direct line of reciprocating movement. As shown in Figs. II, IV and VI of the drawings a vertically movable pressure foot 13 and a cutter head 14 carried by vertically movable rotatable shaft 15, cooperate with the other described elements of the assembly.

Referring now particularly to the showing of Fig. I and II of the drawings, the blades 5 and 6 of the escapement are shown at their limit of movement across feed-way 1 at the base of the inclined slide thereof and toward the bottom of the sheet, to present the bolt blank B for engagement by feed-finger 8 and to hold bolt blank C and the blanks which follow it in series, rearwardly in the slide. Bolt blank A is in position for the cutting operation performed by cutter head 14, which is at the upper limit of its movement and in operative contact with the end of the shank of bolt blank A. The bolt blank is held in position for cutting by pressure foot 13 which holds it against the surfaces of guide blocks 2 and 3 on which it rests. This is the cutting position of the elements shown in Fig. I, with feed-finger 8 (full lines) engaging bolt blanks A and B for discharge and feeding respectively. Fig. I also shows the movement by which the feed-finger has come into propulsive engagement with the two bolt blanks A and B by moving from its rearward position into its advanced bolt-engaging, or gathering, position. This action is shown in the broken outline of the feed-finger, and shows that while bolt blank A is held securely by pressure foot 13 it serves as an abutment against which cam surface 16 of the feed-

finger rides, to deflect the feed-finger against the resistance of spring 12 in its forward movement. In that forward movement the feed-finger therefore is forced outwardly until its notches 10 and 11 are in line with the bolt blanks B an A respectively, and is brought into engagement with them by spring 12 when cam surface 16 has passed the bolt A, so that notches 11 and 10 seat respectively around both the bolt blanks.

Fundamentally the full line position of these elements is shown in Figs. III and IV of the drawings which, however, show the completion of the pointing operation which is the cutting operation performed by the cutter head shown in the drawings. It will be seen in these figures of the drawings, as in Figs. I and II, that nose 17 of feed-finger 8 lies between the two vertically spaced escapement blades 5, with the shank of bolt B engaged in notch 10 of the feed-finger. It may be noted that rails 1a and 1b of feed-way 1 are slotted to accommodate escapement blades 5 and 6 and nose 17 of the feed-finger.

In Figs. V and VI there is shown the return, or feeding and discharging, stroke of the feed-finger, and the position of the escapement to take up the next bolt blank C in the series of blanks travelling down inclined feed-way 1. In these figures of the drawings escapement blades 5 and 6 have moved as a unit toward the top of the sheet, so that bolt C is brought into line with the inclined passage 7 between the chamfered faces 5a and 6a of the blades 5 and 6. It will be understood that the return movement of the escapement blades 5 and 6 as a unit permits bolt blank C to move along inclined passage 7 into a position corresponding to that in the bolt blank B in Figs. I to IV inclusive.

In Figs. V and VI bolt blank A which has been pointed is being discharged from the guide slot 4, and bolt blank B is in position to be contacted and held by pressure foot 13, and to be pointed by cutter head 14. Feed-finger 8 is in its most fully retracted position, at the limit of its bolt discharging and positioning stroke. Pressure foot 13 and cutter head 14 both are retracted vertically, but are about to advance into operative contact with the blank B.

As pressure foot 13 and cutter head 14 move in opposed vertical directions, feed-finger 8 begins its forward bolt engaging movement, there being no appreciable dwell at the end of either stroke of the feed-finger. As the feed-finger begins to move forwardly the blank B is engaged and held stationary by the pressure foot so that the cam surface 16 of feed-finger 8 rides against it as an abutment in the manner shown in dotted lines in Fig. I, until it comes into its engaging relation with the shanks of bolts B and C in notches 11 and 10 respectively. It is to be understood that during this movement in which the pressure foot and the cutter head move in opposed vertical directions and feed-finger 8 moves forwardly with appropriate deflection, the escapement blades have moved downwardly of the sheet into the position shown in Figs. I and II, and that by the inclination of passage 7 the bolt C is brought into and held in position for engagement by the feed-finger.

It readily will be understood from the above that there being no appreciable dwell of the feed-finger at either end of its stroke, the timing of the entire operative cycle including the feeding of the bolt blanks is limited only by the speed with which the cutting operation is performed on the shanks of those bolt blanks. Thus if the cutting operation be a pointing operation,

as shown, the action is rapid. If on the contrary the cutting operation be a proportionally slower threading or extending turning operation, the action of all the cooperative elements is made correspondingly slower. In all instances, however, the action is rapid with respect to the operation which is performed.

As shown in Figs. VII, VIII and IX, the machine as a whole derives its motive power from an electrical motor 18, which has a belt-drive connection 19 with horizontal shaft 20. A hollow vertically arranged spindle 21 is continuously rotated by bevel gears 22 and 23 carried respectively by the spindle 21 and by shaft 20. Interiorly of the hollow spindle 21, shaft 15, carrying cutter head 14, has a splined connection 25 with the spindle. The remaining motions of the cutter head, pressure foot, escapement and feed-finger are produced by motive power transmitted from shaft 20 by way of a reducing gear train 26 including pinion 27 on the shaft 20 and gear 28 on a cam shaft 29. On cam shaft 29 there are keyed a series of cams 30, 31, 32 and 33. These cams respectively impart timed motion for actuating the escapement, for advancing and retracting the pressure foot, for reciprocating the feed-finger, and for advancing and retracting the cutter head.

Referring first to the escapement action as controlled from cam 30 and with particular reference to Fig. XI of the drawings, as well as Figs. I to VI inclusive, the escapement connections comprise an upright rocker arm 34 which carries a roller 35 riding on cam 30 and held in contact with the cam by spring 36 anchored in frame 100 of the machine. Rocker arm 34 has a pivoted sliding connection with a reciprocating slide block 37 which is dove-tailed in a seat in the machine frame. As shown in Fig. XI, escapement blades 5 are carried by the slide block and the cooperative escapement blade 6 is carried by bracket 38 in a position of appropriate opposition to escapement blades 5. Bracket 38 is slidably mounted in frame 100 and a coil spring 39, connected with slide block 37 and with bracket 38 exerts a yielding force in opposition to movement of the slide block and bracket relatively to each other.

The action of these instrumentalities may now be related to the instrumentalities acting directly on the bolt blanks. Considering first the showing of Figs. I to IV inclusive of the drawings, the escapement blades are in their advanced position, with the blades 5 entered behind the bolt B which is being engaged by feed-finger 8 and holding back bolt C in the included slide portion of feed-way 1. From this position the action of cam 30, by rocking arm 34 rearwardly, or to the left in Fig. XI, retracts slide block 37 to carry all the escapement blades rearwardly of the machine, into the position shown in Figs. V and VI. In that position bolt blank C has been allowed to move forward by retraction of escapement blades 5 and lies now against blade 6. When roller 35 rides on to the low region of cam 30 spring 36 moves slide block 37 forwardly to bring the escapement blades again into the position shown in Figs. I to IV. In that position bolt blank C has travelled along the inclined passage 7 between the escapement blades and the blades 5 have moved into position to detain bolt blank D. It will be noted that these connections provide of themselves a safety factor for preventing injury to the machine should a bolt become jammed in feeding. This is because the advancing stroke of the slide block in which the escape-

ment blades enter between bolt blanks is under the yielding force exerted by spring 36, the positive action being in the retraction of blades 5 into the position of Figs. V and VI. In the retracting movement spring 39 may elongate to permit separation between blades 5 and blade 6 in the event that escapement blade 6 meets excessive opposition.

Considering next the connections for operating feed-finger 8 because of the fact that the feed-finger cooperates most directly with the escapement, those connections comprise cam 32 which acts on an upright rocker arm 40 having a roller 41 which is held in contact with the face of the cam by a spring 42. Referring particularly to Fig. X in conjunction with Figs. I to VI inclusive, rocker arm 40 has a pivoted connection with connecting link 43 comprising a turnbuckle 44. A connecting arm 45 is mounted on a pin 46 and is held in engagement with an arm 47 by means of a coil spring 49. The outer end of connecting arm 47 is forked at 47*a* and embraces a pin 47*b* mounted in a slide block 48. Slide block 48 which has a sliding dove-tail fit in a cooperatively shaped seat in the frame of the machine carries feed-finger 8 pivotally mounted at 9 on the slide block. Feed-finger 8 is limited positively against rotation in one direction by a set screw 50 and rotation in the other direction is yieldingly opposed by a compression spring 12.

By its crank connections slide block 48, carrying feed-finger 8, is reciprocated in accordance with the face design of cam 32 acting on rocker arm 40. This cam 32 can be, and desirably is designed to give no appreciable dwell at either end of the slide block stroke. By it the reciprocating motion of the feed-finger is synchronized with the action of the escapement and with the other agencies which act directly on the bolt blanks. The advancing, or gathering, movement of the feed-finger does not await the completion of the cutting operation, but that movement takes place while a bolt blank is still held in the working station of the machine with the head of the bolt blank forced downward against guide blocks 2 and 3 by pressure foot 13, and with cutter head 14 still in operation. By the time the cutting operation is completed the feed-finger has been brought by its forward movement and by the expanding force of spring 12 into a position with its notches 10 and 11 engaging respectively the bolt next to be fed and the bolt in the working station.

As a precaution against deflection of the bolt shanks from a vertical position suitable for the action of the working head, guide slot 4 desirably is extended vertically in opposition to the force exerted by the feed-finger by a skirt 3*a* on guide block 3 to increase the depth of the guide slot along its outer side, as shown in Fig. X*a* of the drawings.

The safety feature of the connections for actuating the feed-finger is provided by the yielding means which holds the angular extension of arm 45 in yielding engagement with arm 47. If serious resistance to the forward, or gathering movement of feed-finger 8 is presented, arm 45 and arm 47 can separate against the resistance of spring 49, so that by the yielding of spring 49, or the spring 42 which holds rocker arm 40 to the cam, forced movement of the feed-finger against positive resistance in either direction of its reciprocation is prevented.

As shown in Fig. XII the connections for actuating pressure foot 13 comprise cam 31 which acts on a rocker arm 51 carrying a roller 52 held to the cam by spring 53 anchored in the machine frame. Rocker arm 51 is a bell-crank form. It is pivoted to the machine frame by pin 54 and has its outer end pivotally connected at pin 55*a* with the outer end of a spring lever 55 which bears against a sliding plunger 56 carrying pressure foot 13. Rearward end of spring lever 55 is supported by a vertically arranged coil spring 57 carried on shelf 51*a* of rocker arm 51, the follower 58 of which is connected to the spring lever by compression-adjusting screw 59. An adjusting screw 56*a* forms an extension of sliding plunger 56 and serves to adjust the vertical position of sliding plunger 56, and thus to determine the vertical position of the path through which the pressure foot is reciprocated.

Relating the actuation of the pressure foot with the showing of Figs. I to VI of the drawings, the action of cam 31 in swinging the lower end of bell-crank 51 toward the rear of the machine, acting through pin 55*a* depresses the forward end of spring lever 55. This brings pressure foot 13 into contact with the head of the bolt blank which is to be acted on in the position shown in Figs. I to IV of the drawings. Cam 31 is so designed that it gives an appreciable dwell of the pressure foot in this position, by holding the lower end of bell-crank 51 rearwardly against the resistance of spring 53. This position persists throughout that period in the cycle of operations in which the feed-finger 8 is advancing and cutter head 14 is performing its operation. As cam 31 comes into position to release rocker 51 to the action of spring 53, pressure foot 13 is retracted to permit discharge of the bolt blank on which the cutting operation has been performed, as shown in Figs. V and VI. In this organization the spring 57 gives an accommodation to variation in the thickness of the heads of the bolt blanks. If the head is of more than expected thickness relief is provided by the spring; conversely the relief provided by the spring permits the maximum positive stroke to be made long enough to engage bolt blanks having heads which are unexpectedly thin.

Referring particularly to Fig. XIII of the drawings, an extension 65 of arm 60 is held yieldingly in engagement with a gear housing 66, to which shaft 61 is engaged, by means of a coiled relief spring 67. Shaft 61 carries a pinion 68 which meshes with a rack 69 on sleeve 24 in which shaft 15 is rotatable. As noted, shaft 15 carries cutter head 14 and has a splined connection 25 with tubular spindle 21. Swinging movement of arm 60 under the influence of cam 33 and return spring 64 thus rotates shaft 61 and pinion 68 to advance and retract the cutter head. A safety factor is provided by the yielding engagement between arm 60 and shaft 61 which is provided by spring 67 acting on extension 65 of arm 60 and housing 66.

The region of reciprocation through which cutter head 14 is carried in advancement and retraction of shaft 15 can be adjusted, by vertical adjustment of the shaft to a determined vertical level from which it is advanced and to which it is retracted. This is done by a manual operation of pinion 68. The means for effecting this adjustment, shown in Fig. XIII, comprises a worm 70 carried by shaft 71 which is mounted in and projects from gear housing 66. A worm wheel 72 meshing with worm 70 is keyed to pinion shaft 61. Manual rotation of worm shaft 71 as

by a wrench engagement of its projecting portion thus serves to rotate pinion shaft 61 and to move sleeve 24 and shaft 15 upwardly or downwardly with respect to the fixed position of the working station. This adjustment obviously gives accommodation to bolt shanks of different lengths on which the cutter head is to operate, by shortening or lengthening the relative distance between the cutter head and the fixed structure of the guide slot in which the bolt is held. If a shank of unexpectedly great length is presented, injury to the cutter head is prevented by the yielding connection provided by spring 67 which permits arm 60 to swing without enforced movement of pinion 68 and the cutter-carrying shaft 15.

It will be seen from the above that the actual finishing operation of the machine is performed by two elements which are movable vertically in opposite directions, namely pressure foot 13 and cutter head 14, the bolt blanks being held by pressure against their heads during the cutting operation, and the cutting being performed by a rotating cutter. This eliminates the requirement for a chuck into which a bolt blank must be inserted and from which it must be removed.

It is also desirable that the bolt blanks remain in the same position, which is a position of approximate vertical suspension from their heads, during all the operations performed in feeding, cutting and discharging the bolt blanks. This of itself leads to structural simplicity in the organization of the machine, and to rapid operation of the machine. The feature of maintaining the work-pieces, or bolt blanks, in vertically extended position throughout the entire feeding and operating sequence of the machine permits those blanks to be discharged from the machine in the same upright position. They can be retained in upright position by conveyance in a declining feed-way 73 formed as an extension of the guide slot, and in that position they can be received by a subsequent machine or other agency without realignment. Thus a machine organized to perform a pointing operation as disclosed herein may discharge bolt blanks to a second substantially identical machine in which by a similar sequence of steps the pointed blank is threaded.

By the timed sequence in the movement of the tools which are in direct contact with the bolt blanks, those tools are made to perform cooperative functions which also lead to structural simplicity and to operating speed. Thus the escapement and the pressure foot cooperate in placing two bolts in position to be engaged by the feed-finger for positioning under the pressure foot and for discharge respectively. The action of the pressure foot cooperates with the feeding of the bolts by holding a bolt in position to provide a deflecting abutment for the feed-finger, in addition to its function in holding the bolt in position for the operating tool of the assembly to act on the bolt shank. The feed-finger in its forward, or gathering, stroke engages not only a bolt blank which is to be fed to the working station but also engages the bolt blank then in the working station, which is the work-piece next to be discharged. In its return stroke the feed-finger both feeds one bolt blank into working position and discharges another bolt blank from that position. By the telescoping of functions in terms of time consumed, the action of the machine is made so rapid that a machine having a single working head is able to perform its finishing operation on a great number of bolts for any given operating period, thus avoiding the necessity for a great number of single-acting machines and the complication of a multiple machine comprising a plurality of working heads. The simplicity of the work-contacting tools and the rapidity of their operation leads also to simplicity in the power-transmitting connections, which in addition to the safety features comprised in the machine minimize time lost by shut-down for repairs.

It has been noted that the machine will perform a variety of cutting operations such as pointing, threading, shank turning, and the like, on work-pieces of the general nature of bolt and screw blanks in that they are work-pieces each comprising a head and shank. It may here be noted that the operation performed on the work-piece by the operating element may be a polishing operation or other operation performed on the shank of the work-piece other than by cutting. The heads of the blanks constituting the work-pieces may be of different forms and shapes without detriment to the operation of the machine. It is necessary merely to apply a pressure foot which is terminally shaped to the head form of the work-pieces on which it is desired to operate in order to adapt the machine to different head forms. Thus the terminal of the pressure foot may have a cavity shaped to the contour of the heads of the work-pieces, may have a cavity shaped to exert a wedging action on the head of the work-piece, or may in some instances be a plane surface.

It also is to be understood that, by the use of appropriate tool, the working head may perform a straight planing action on the work-piece, such as a grooving operation on the shank of a solid headed work-piece or a slotting operation on a tubular headed work-piece. Because the only structural modification in the machine which would be required for such modified action is the omission of connections for rotating the cutter head, such modification obviously requires no illustration.

The machine is very flexible in the sizes and relative proportioning of work-pieces on which it operates. Thus the stroke of each of the instrumentalities acting directly on the work-pieces may initially be controlled by cam design. Further the effect of the escapement may be adjusted to work-pieces having shanks of different diameter by relative positioning of the escapement blades to give a wider or narrower inclined passage between the blades; the effective stroke of the pressure foot may be adjusted by adjusting the stroke location of the slide block which carries the pressure foot; the stroke of the feed-finger may be adjusted by adjusting the length of the connecting link through which the slide block which carries the feed-finger receives propulsion; and, as described in detail, the stroke location of the shaft which carries the operating head also may be adjusted. With these accommodations to the size of the work-pieces on which the machine is to be run, there are associated the described safety means which prevent damage by individual off-size work-pieces when they are accidentally supplied to the machine.

I claim as my invention:

1. In a machine for performing finishing operations on bolt blanks and like headed work-pieces, the combination of a feed-way slotted for extension of the shanks of bolt blanks vertically therethrough and to support the bolt blanks by underlying the heads thereof, a fixed slotted anvil forming an extension of the said feed-way

similarly to support a bolt blank with the under face of the head thereof lying against the upper face of the anvil as an abutment, a pressing plunger and actuating means therefor organized vertically to move and to maintain the said pressing plunger in holding contact with the head of the bolt blank against the upper surface of the said slotted anvil, a working head cooperative with the said pressing plunger and movable vertically in operative alignment therewith into operative relation with the shank of a bolt blank held with its head forced against the upper surface of the said anvil by the said pressing plunger, a feed-finger having bolt-engaging means therein reciprocable along the said feed-way in a path overlapping the slot of the said anvil and obstructed by a bolt blank held therein, the said feed-finger being pivoted for swinging deflection by contact with a bolt held by the pressing plunger to pass along the said bolt in one direction of movement, and yielding means arranged to act on the said feed-finger to engage it with a bolt blank to bring the same into operative position in the said slotted anvil under the said pressing plunger by movement of the feed-finger in the opposite direction.

2. In a machine for performing finishing operations on bolt blanks and like headed workpieces, the combination of means for supporting a series of bolt blanks in vertical position by suspension from their heads, a fixed slotted anvil positioned to receive bolt blanks from said bolt-supporting means similarly to support a bolt blank with the under face of the head thereof lying against the upper face of the anvil as an abutment, a pressing plunger and actuating means therefor adapted vertically to move the said plunger toward the said slotted anvil and to maintain the said pressing plunger in holding contact with the head of a bolt blank against the upper surface of the said anvil forcefully to maintain the bolt blank stationary for performance of a finishing operation on the shank of the bolt blank, a reciprocating member, a feed-finger pivotally mounted in said reciprocating member and arranged to travel in a path over-lapping the slot of the said anvil and obstructed by a bolt blank held in the anvil, a surface of the said feed-finger presented toward the slot of the said anvil and shaped to cause swinging deflection of the feed-finger in one direction of its movement a bolt-engaging seat in the said feed-finger presented toward the bolt blanks supported in series, means yieldingly opposing swinging deflection of the said feed-finger to pass the bolt held in the anvil and to bring the said feed-finger into position to engage a bolt to be fed to said anvil in the seat thereof, and means for presenting bolts one at a time from series for engagement by the said feed-finger.

3. In a machine for performing finishing operations on bolt blanks and like headed workpieces, the combination of means for supporting a series of bolt blanks in vertical position by suspension from their heads, a fixed slotted anvil positioned to receive bolt blanks from said bolt-supporting means similarly to support a bolt blank with the under face of the head thereof lying against the upper face of the anvil as an abutment, a pressing plunger and actuating means therefor adapted vertically to move the said plunger toward the said slotted anvil and to maintain the said pressing plunger in holding contact with the head of a bolt blank against

the upper surface of the said anvil forcefully to maintain the bolt blank stationary for performance of a finishing operation of the shank of the bolt blank, a reciprocating member, a feed-finger pivotally mounted in said reciprocating member and arranged to travel in a path overlapping the slot of the said anvil and obstructed by a bolt blank held in the working station, a surface on the said feed-finger presented toward the slot of the said anvil and shaped to cause swinging deflection of the feed-finger in one direction of its movement, bolt-engaging seats in the said feed-finger presented toward the bolt blank in the anvil and the bolt blanks supported in series, means yieldingly opposing swinging deflection of the said feed-finger to pass the bolt held in the anvil and to bring the said feed-finger into position to engage the bolt in the anvil and a bolt to be fed to said anvil respectively in the seats thereof, in movement of the said reciprocating member in one direction and respectively to discharge the bolt blank in the anvil and position the other bolt blank therein in movement of the said reciprocating member in the opposite direction, and means for presenting bolts one at a time from series for engagement by the said feed-finger.

4. In a machine for performing finishing operations on bolt blanks the combination of an extended straight line feed-way constructed and arranged for the propulsion of bolt blanks therealong to and past a working station therein and to discharge with the bolt blanks suspended in approximately vertical position by contact of their heads with the upper surface of the said feed-way, the said feed-way including a slotted anvil providing the working station thereof, a pressing plunger and actuating means therefor adapted vertically to move the said plunger toward the said slotted anvil to maintain the said pressing plunger in holding contact with the head of the bolt blank in the said anvil by downward pressure on the head of the said blank against the structure of the slotted anvil forcefully to maintain the bolt blank stationary, a reciprocating member, a feed-finger pivotally mounted in said reciprocating member and arranged to travel in a path overlapping the slot of the said anvil and obstructed by a bolt blank held therein, the surface of the said feed-finger presented toward the slot of the anvil being shaped to cause swinging deflection of the feed-finger against a bolt blank held in the anvil, bolt-engaging seats in the said feed-finger presented toward a bolt blank in the anvil and toward bolts supported in the said feed-way, yielding means opposing swinging deflection of the said feed-finger to pass the bolt blank held in the anvil and acting to bring the said feed-finger into position to engage a bolt blank in the anvil and a bolt blank to be fed to the anvil respectively in the seats thereof in movement of the said reciprocating member in one direction and respectively to discharge the bolt blank in the anvil and position the other bolt blank therein in movement of the said reciprocating member in the opposite direction.

5. In a machine for performing finishing operations on bolts the combination of a feed-way constructed and arranged for the propulsion of bolt blanks therealong, a slotted anvil formed as a continuation of said feed-way and providing a working station for the action of a working head on successive bolt blanks, means for holding a

bolt blank in said anvil, a reciprocating member, a feed-finger pivotally mounted in said reciprocating member and arranged to travel in a path overlapping the slot of the said anvil and obstructed by a bolt blank held therein, the surface of the said feed-finger presented toward the slot of the anvil being shaped to cause swinging deflection of the feed-finger against a bolt blank held in the anvil, bolt-engaging seats in the said feed-finger presented toward a bolt blank in the anvil and toward bolts supported in the said feed-way, yielding means opposing swinging deflection of the said feed-finger to pass the bolt blank held in the anvil and acting to bring the said feed-finger into position to engage a bolt blank in the anvil and a bolt blank to be fed to the anvil respectively in the seats thereof in movement of the said reciprocating member in one direction and respectively to discharge the bolt blank in the anvil and position the other

bolt blank therein in movement of the said reciprocating member in the opposite direction.

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