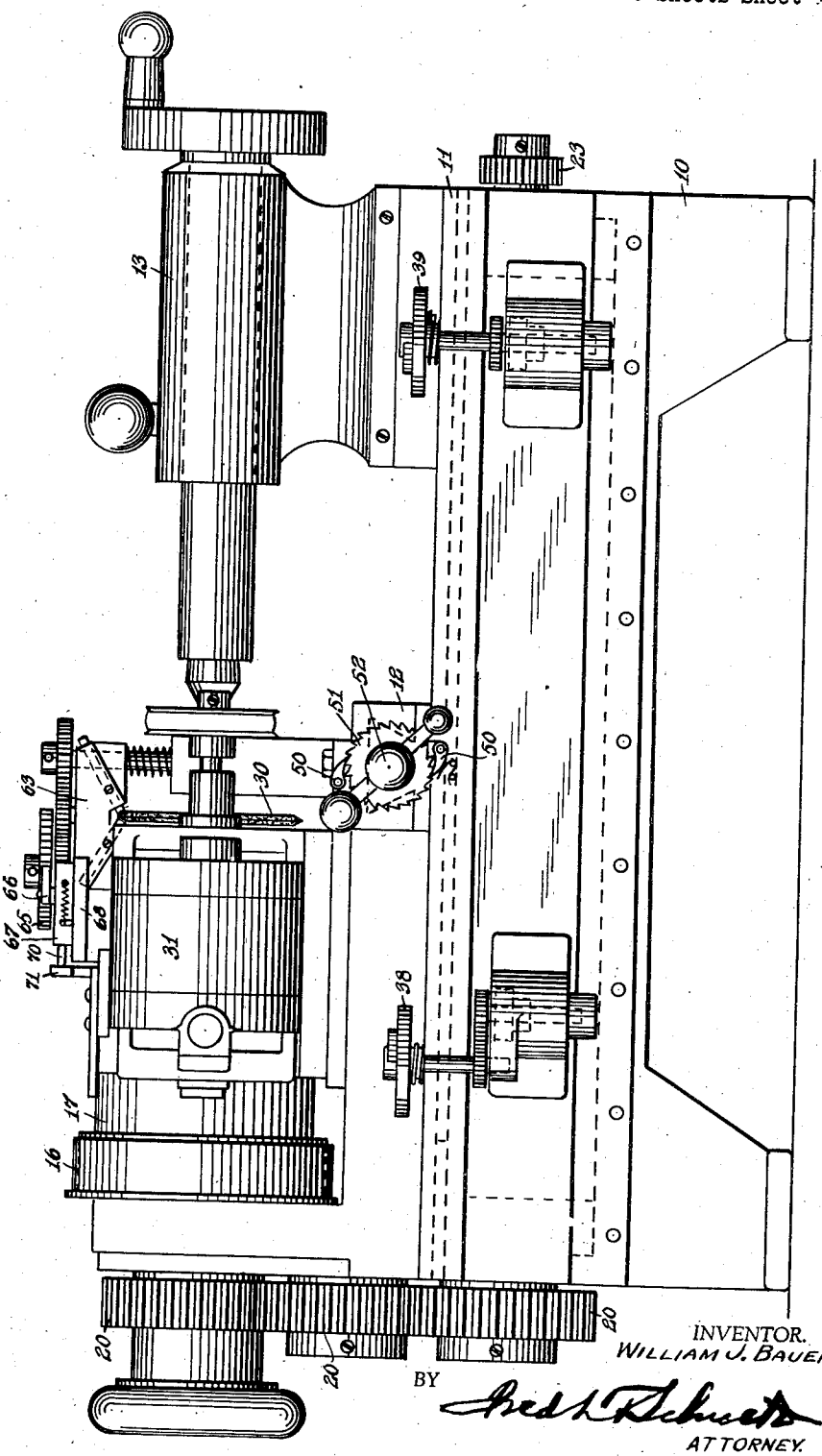
July 10, 1945. W. J. BAUER 2,380,286

MACHINE FOR AUTOMATICALLY GRINDING THREAD GAUGES AND THE LIKE

Filed July 10, 1942 5 Sheets-Sheet 1

Fig. 1.




INVENTOR.
WILLIAM J. BAUER

BY

ATTORNEY.

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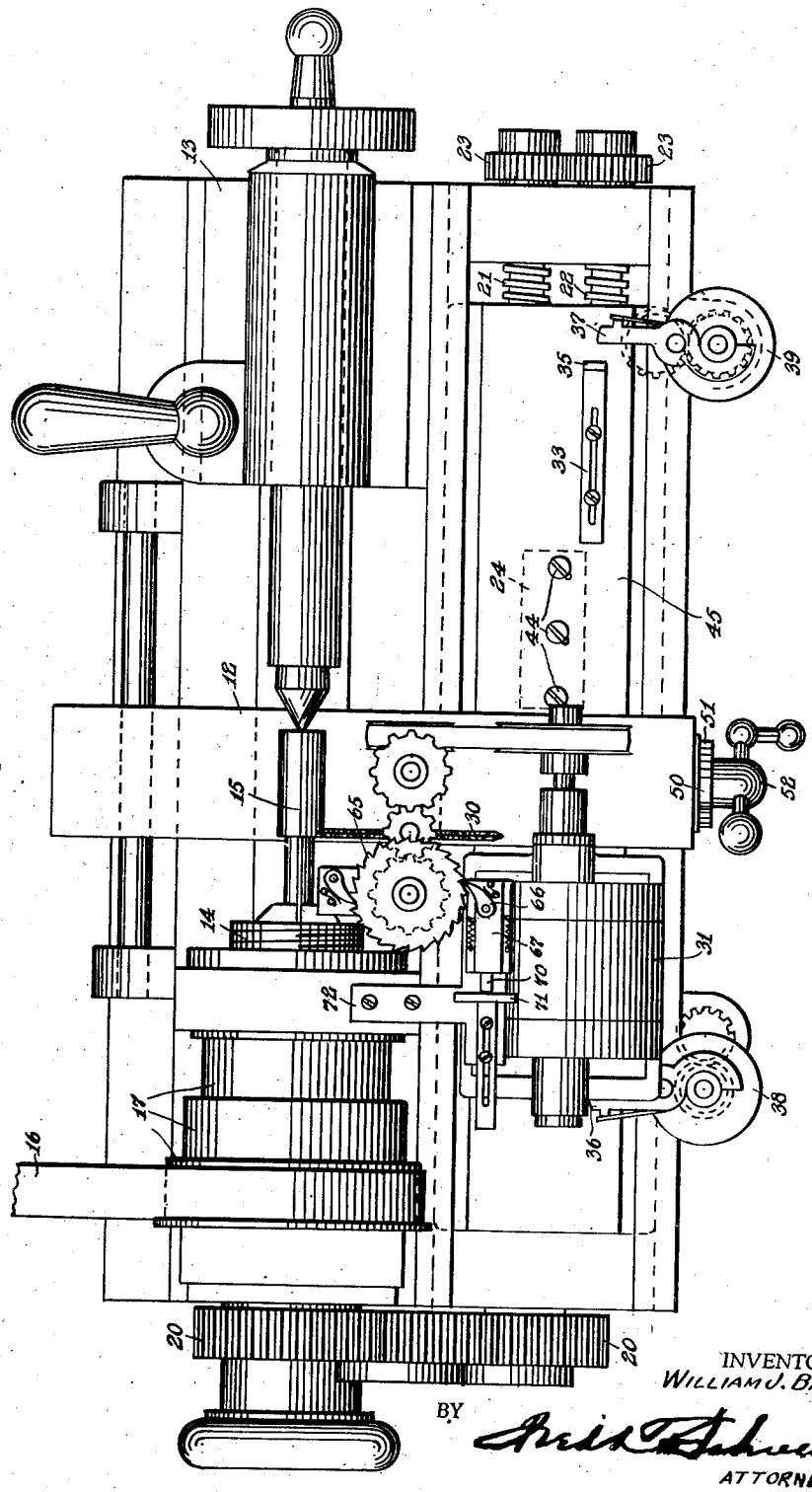


Fig. 2.

INVENTOR.
WILLIAM J. BAUER

BY

ATTORNEY.

July 10, 1945. W. J. BAUER 2,380,286

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Fig. 4.

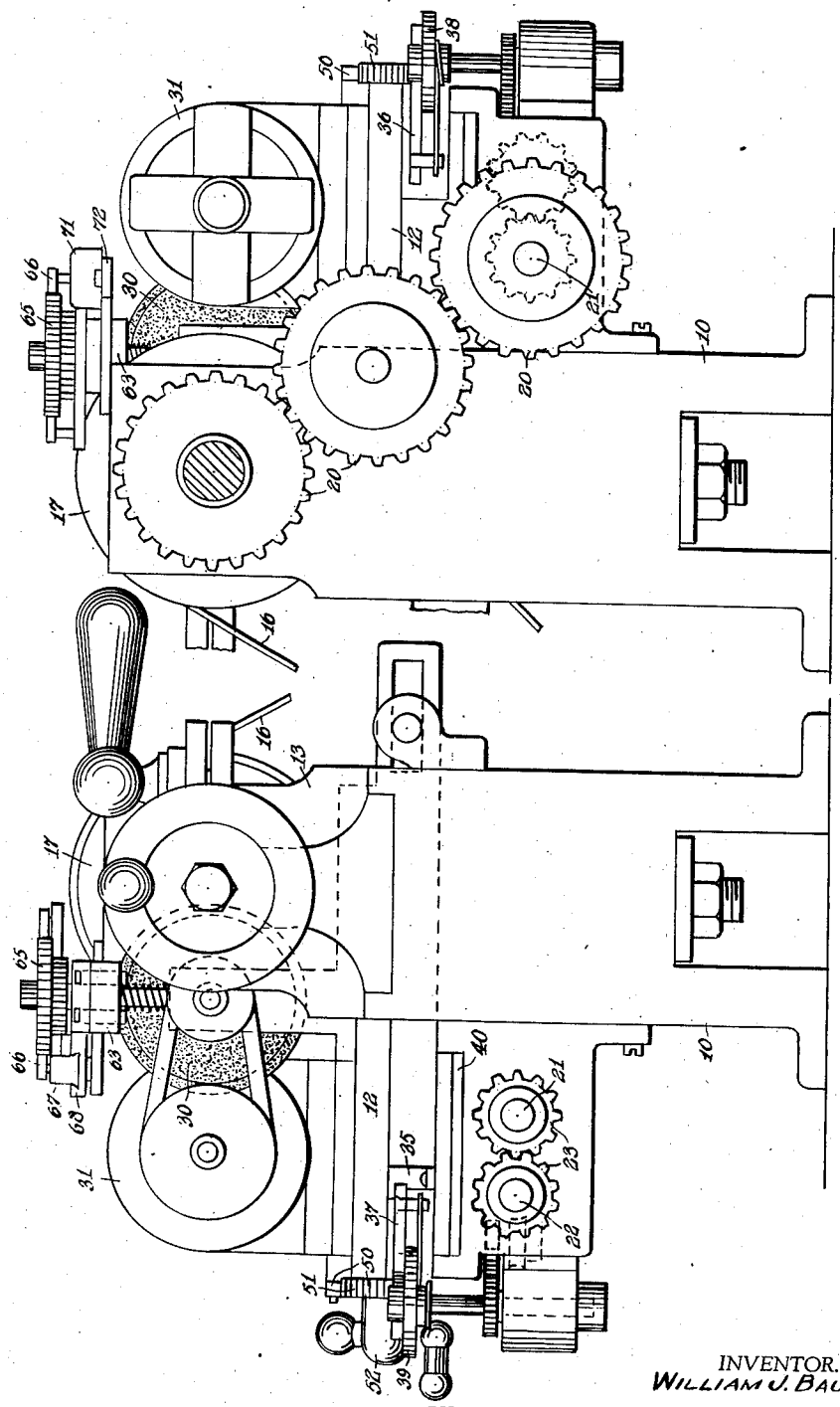


Fig. 3.

INVENTOR.
WILLIAM J. BAUER

BY

ATTORNEY.

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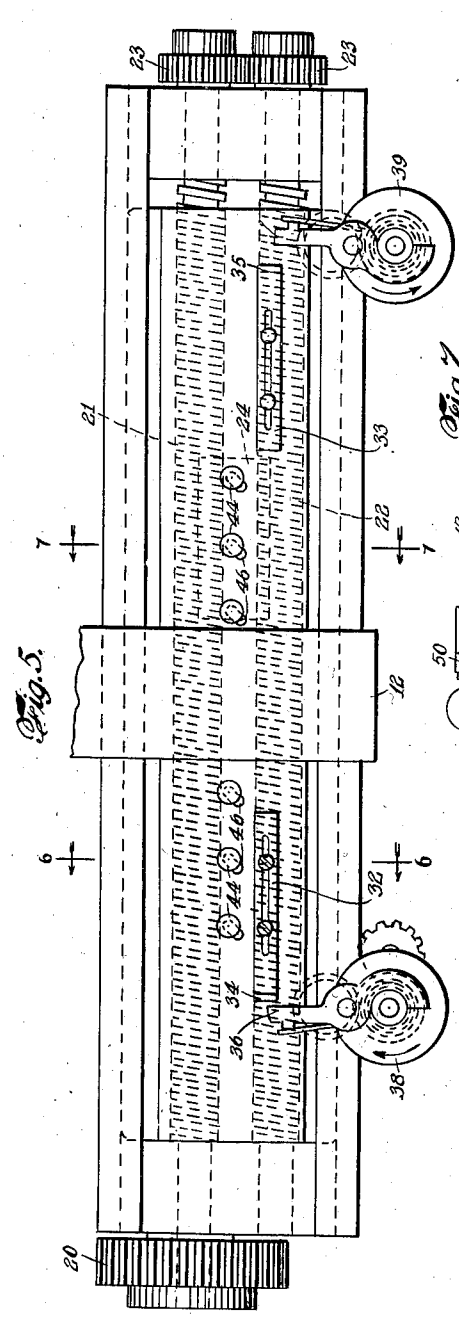

Fig. 5.

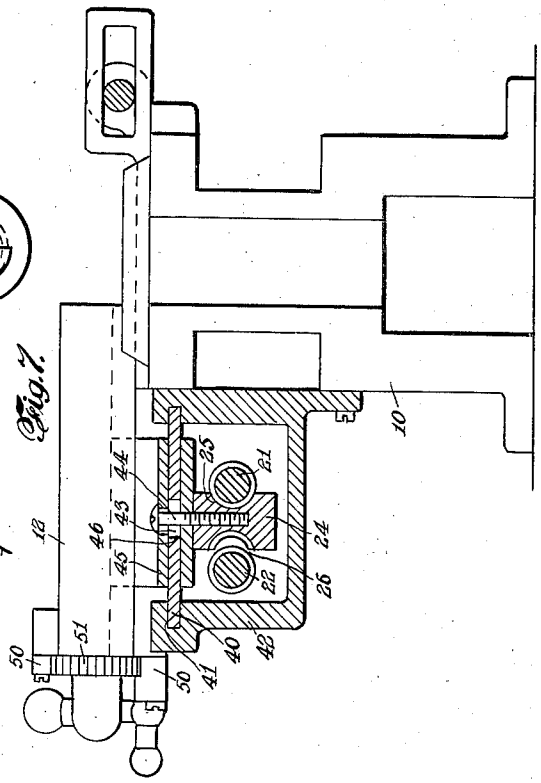

Fig. 7.

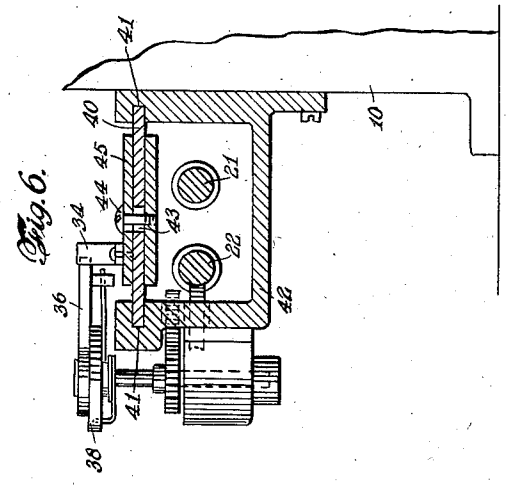

Fig. 6.

INVENTOR.
WILLIAM J. BAUER

BY

ATTORNEY.

July 10, 1945. W. J. BAUER 2,380,286

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Fig. 8.

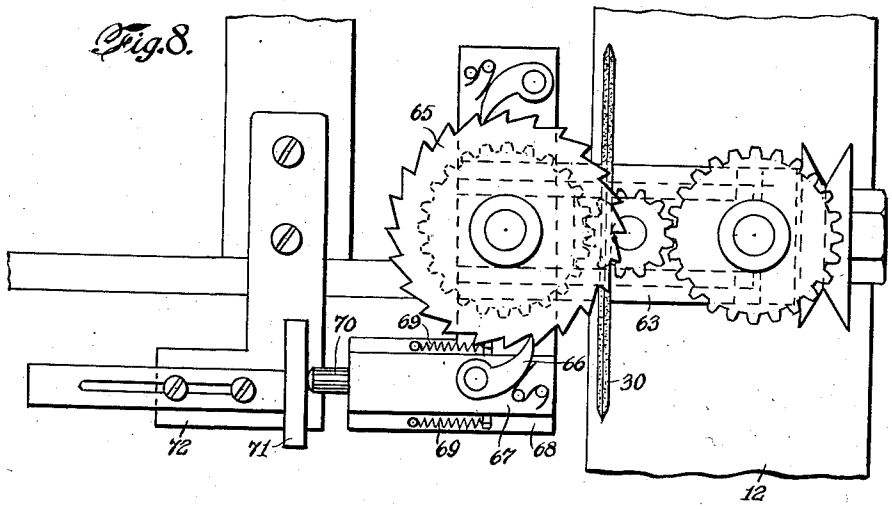
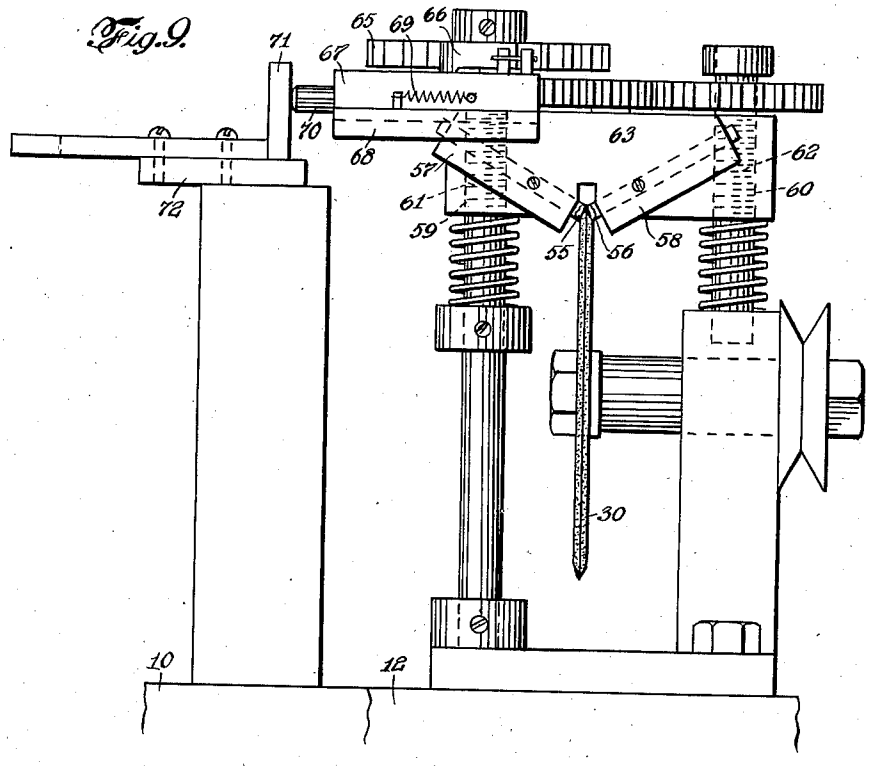



Fig. 9.




INVENTOR.
WILLIAM J. BAUER
BY
ATTORNEY.

Patented July 10, 1945 2,380,286

# UNITED STATES PATENT OFFICE

2,380,286

## MACHINE FOR AUTOMATICALLY GRINDING THREAD GAUGES AND THE LIKE

William J. Bauer, New York, N. Y., assignor of fifty one-hundredths to John L. Dudley and fifty one-hundredths to James J. Moroney, both of Pleasantville, N. Y.

Application July 10, 1942, Serial No. 450,427

6 Claims. (Cl. 51—50)

The invention relates to a novel method of producing accurate gauges of hardened stock, such as plug and thread gauges as well as taps and threads generally, and to a machine for automatically cutting such threads and plugs.

Heretofore, the procedure has been substantially as follows: Annealed but not hardened steel is first machined to the approximate final form of the gauge and the thread cut thereon. After this gauge is hardened, which invariably produces distortion; and to secure accuracy of thread form and pitch a grinding wheel is run over the thread and successively manually fed inwardly to remove the inaccuracies caused by distortion resulting from the hardening process. As the grinding wheel wears with each grinding cycle, it is necessary for an operator to watch the whole operation with great care and, when the grinding wheel has worn sufficiently, to remove said wheel and re-form or dress its grinding surface. The wheel must then again be reset in the machine with great care so that during the successive grindings it will track properly with the part being ground.

All of this involves not only constant attention and care on the part of an operator, but requires also that such operator be highly skilled. The finished article, furthermore, depends upon the care and skill and experience of the operator to a very marked degree.

The present invention has for an object to render the production of these thread and like gauges largely automatic.

A further object of the invention is to provide a novel method which eliminates any necessity of regrinding a thread because of distortion thereof.

Another object of the invention is to provide for the automatic dressing of the grinding wheel used for cutting the threads, as well as for the automatic cross-feeding of the grinding wheel.

Still another object of the invention resides in novel constructional features of the machine utilized for the carrying out of the novel process.

In carrying out the process, a rough machining of annealed but not hardened steel stock is effected to provide a blank of suitable but only approximate contour, and the blank is then hardened. Thereupon, the blank is machined to the exact final size and contour desired, and the thread is cut therein automatically by a suitable grinding wheel. The accuracy of grinding, furthermore, is maintained by periodically dressing the wheel, that is to say, during a period in which it is temporarily withdrawn from the surface of the blank, for example, at the completion of each cycle of grinding or engagement with the blank. The successive cycles of grinding with increment of cross-feed of the grinding wheel are maintained automatically together with the dressing operation until the desired depth of thread is attained.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawings, in which:

Fig. 1 is a front elevation of the novel grinding machine with a blank in position for having thread ground therein.

Fig. 2 is a plan thereof.

Figs. 3 and 4 are elevations of the respective ends of the machine.

Fig. 5 is a fragmentary plan of the machine bed with carriage movable thereon.

Figs. 6 and 7 are transverse sectional views taken respectively on the lines 6—6 and 7—7, Fig. 5, and looking in the direction of the arrows.

Fig. 8 is a fragmentary plan view, and Fig. 9 a fragmentary elevation of the grinder wheel dressing means and feeding mechanism therefor, both views being on an enlarged scale.

Referring to the drawings, 10 designates a suitable supporting frame having the bed 11 over which is adapted to travel longitudinally thereof, as well as to have a transverse movement relatively thereto, a slide-rest or carrier 12. On the bed is mounted an adjustable tailstock 13 for retaining between the same and a rotatable chuck 14 the blank 15 to be ground as hereinafter set forth. Rotation of the blank is derived, for example, from a belt 16 through the stepped pulley 17 whereby the desired rotational velocity may be imparted to the blank.

Power from the belt 16 is communicated through intermediate gearing 20 to a pair of horizontally disposed lead screws 21 and 22, the former being driven directly and the latter therefrom through a pair of spur gears 23, said lead screws running in opposite directions. These lead screws are rotatably mounted in the frame below the bed 11 thereof and are designed to be alternatively engaged by a downward extension 24 of the carrier. To this end, the carrier extension is provided on its opposite vertical faces with nut elements 25 and 26 which are open or only half of a complete nut.

These elements are disposed adjacently the corresponding lead screws and are adapted for respective engagement therewith, the carrier with extension being laterally displaceable to this

end so that one or the other of the two nut elements will be in engagement with its corresponding adjacently disposed lead screw. The purpose of this action is to impart automatically to the carrier a reciprocatory motion along the bed, that is to say, the carrier will be advanced a predetermined distance toward the tail-stock, then withdrawn laterally and engaged by the other of the lead screws to return the carrier to its initial location, whereupon it is moved inwardly toward the blank in being laterally displaced for engagement with the advancing lead screw. This lead screw provides the proper feed to conform to the desired thread to be cut, or rather ground, in the blank.

This action is effected by a suitable grinding member 30 mounted for continuous rotation on the carrier 12 and driven from a motor 31 also mounted upon the carrier.

As hereinbefore noted, the reciprocation of the carrier and the displacements thereof are to be effected automatically as through suitable stops 32 and 33 adjustably secured to the upper surface of the carrier, said stops being provided with respective up-turned lips 34 and 35 at their outer ends. These are adapted for engagement with continuously rotatable deflecting means such as the spring-urged yieldable arms 36 and 37 mounted upon and rotatable with corresponding disks 38 and 39. These disks rotate in opposite directions, that is to say, in the direction opposite the advance of the corresponding carrier stop, the yieldable means being adapted for engagement with the lip of such stop when the latter comes within the orbit of such deflecting means, imparting thereby to the carrier a lateral displacement. Movement for effecting the rotation of the disks 38 and 39 is received through intermediate gearing, Fig. 6 of the drawings, from one of the lead screws, preferably the driven lead screw 22.

In order to admit of this lateral displacement of the carrier which is mounted for reciprocation through a plate 40 movable in lateral ways 41 of a housing 42 attached to frame 10 along the front thereof, said plate is provided with a succession of longitudinally disposed slots 43 through which pass corresponding screws 44 threaded into the extension 24 of the carrier. Over the plate 40 is provided a longitudinally extending cover plate 45 which is provided with diagonally disposed slots 46 coaxial with the slots 43, a screw 44 passing through both of these slots and its head overlapping the latter. This will permit the assembly of the carrier and extension to allow of relative motion or lateral displacement between plate 40 and the extension to accommodate the movement necessary for the alternative engagement of the nut elements 25 and 26 with the respective lead screws 21 and 22.

The grinding member 30 is mounted upon the carrier 12 for manual cross-feed or adjustment thereon in the usual manner, as in being dovetailed therewith, as well as for automatic feed of the grinding means toward the blank 15 during the successive cycles of operation. That is to say, after a cut has been made, and the grinder withdrawn with its carrier from the blank, a feeding of the grinding means takes place substantially upon the completion of the return movement of the carrier. For example, a pawl 50 mounted upon a rigid portion of the frame 10 rides over the teeth of a ratchet wheel 51 so that when the carrier again advances after first having been displaced laterally, a predetermined rotation of ratchet wheel 51 is effected and imparts to the manual feed spindle 52 this rotation for cross-feeding the grinding means.

Provision is made, also, for dressing the grinding means, this being accomplished automatically also from the return movement of the carrier. Thus, reference being had to Figs. 8 and 9 of the drawings, there is mounted above the grinding means or wheel 30 a pair of grinding elements 55 and 56, such as diamond dressers, the same being removably mounted in corresponding holders 57 and 58 designed to direct the grinding element at the proper angle for contact with the periphery of the grinding means. A progressive downward feed is designed to be imparted to the holders through the rotation of lead screws 59 and 60 fitting corresponding threads 61 and 62 of a block 63 carrying the holders 57 and 58. The proper rotational movement is imparted to these lead screws through intermediate gearing and a ratchet wheel 65 designed to be intermittently rotated by an advancing pawl 66 carried by a slide 67 mounted in a block 68 for relative longitudinal movement thereof. The slide is spring-urged by means of a pair of springs 69 connecting the block and slide, and has extending outwardly from the block a plunger portion 70. It will be understood that all of the foregoing mechanisms are mounted upon and move with the carrier 12. The said projecting portion is designed to engage with a stop element 71, adjustably mounted upon a fixed portion of the frame as upon a bracket 72 attached thereto, engagement between the two occurring substantially at the termination of the return movement of the carrier. When such contact occurs, the pawl 66 will be temporarily pushed ahead to rotate ratchet wheel 65 and when the carrier again advances, said pawl will slide over the teeth of the ratchet upon interruption of the contact between plunger portion 70 and the stop 71, the plunger portion returning to its normal extended position, indicated in Fig. 8, under the influence of the springs 69 and thus being positioned for a subsequent feed of the dressing means when the carrier again returns to its starting position.

The sequence of operation is substantially as follows: After the properly machined and hardened blank has been positioned on the machine, the respective stops 32 and 33 are set to conform to the required length of cut or grinding and the stop 71 also set to provide the desired degree of feeding of the dressing means for the grinder 30. The latter is then manually fed inwardly to contact with the surface of the blank. Upon power now being applied to the machine, lead screw 21, being in engagement with the extension 24 of the carrier, will cause the latter to be longitudinally advanced along the blank until stop 33 is engaged by the deflecting member 37 which effects lateral displacement of the carrier. This results in disengagement of the extension 24 with lead screw 21 and its engagement with lead screw 22 for return movement of the carrier to its initial location. At this point, the stop 32 will be engaged by deflecting member 36 to reestablish the engagement between the extension 24 and lead screw 21 for the advance movement of the grinding wheel 30. To this, however, there has been imparted in the meantime an increment of cross-feed through the pawl and ratchet mechanism 50—51 so that actual grinding of the blank will occur. This takes place at each successive cycle so that the desired depth of the thread is thus automatically eventually attained; and it will not be necessary, furthermore, to withdraw the grind-

ing wheel for dressing the same as this is also accomplished automatically through engagement of the plunger 70 with the stop 71 whereby the dressing means are periodically fed toward the wheel by the ratchet mechanism 65.

I claim:

1. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier, means to advance the grinder with carrier longitudinally of the blank when the grinder is in contact therewith, means to return said grinder with carrier longitudinally of the blank when withdrawn therefrom, together with means for displacing the grinder carrier laterally in opposite directions respectively at the completion of its advance and of its return longitudinal movements, dressing means movable with the carrier and associated with the grinder, together with means for feeding said dressing means into contact with the grinder, and means adapted to contact the carrier during its return movement for actuating the means for feeding the dressing means.

2. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier, means to advance the grinder with carrier longitudinally of the blank when the grinder is in contact therewith, means to return said grinder with carrier longitudinally of the blank when withdrawn therefrom, together with means for displacing the grinder carrier laterally in opposite directions respectively at the completion of its advance and of its return longitudinal movements, means movable with the carrier for cross-feeding the grinder thereon toward the blank, means adapted to contact the carrier during its return movement for actuating the cross-feed means, dressing means movable with the carrier and associated with the grinder, together with means for feeding said dressing means into contact with the grinder, and means adapted to contact the carrier during its return movement for actuating the means for feeding the dressing means.

3. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier bearing oppositely disposed open nut elements, a lead screw adapted for engagement with one of the nut elements to advance the carrier with grinder longitudinally of the blank, a second lead screw adapted for engagement with the other of the nut elements to return said carrier with grinder, and means adapted to contact the carrier at the ends of its reciprocations to displace the carrier laterally for engagement of its respective nut elements with a corresponding lead screw.

4. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier bearing oppositely disposed open nut elements, a lead screw adapted for engagement with one of the nut elements to advance the carrier with grinder longitudinally of the blank, a second lead screw adapted for engagement with the other of the nut elements to return said carrier with grinder, and means adapted to contact the carrier at the ends of its reciprocations to displace the carrier laterally for engagement of its respective nut elements with a corresponding lead screw, including adjustable means on the carrier to engage said contact means.

5. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier bearing oppositely disposed open nut elements, a pair of lead screws and means to rotate the same continuously, and means actuated from the movement of one of the screws to displace laterally the carrier into engagement with the other of the screws.

6. In a machine for grinding metal articles: a supporting frame, a support for a blank carried by said frame, means to rotate the blank in the support, a rotary grinder associated with the support adapted for movement radially toward and away from a blank retained therein and including a laterally and longitudinally movable supporting carrier bearing oppositely disposed open nut elements, a pair of lead screws and means to rotate the same continuously, and a pair of fixedly located deflecting means rotated by one of the lead screws and each including a yieldable deflecting element, together with means movable with the carrier for engagement with the respective deflecting elements at opposite ends of its travel whereby to displace the carrier laterally.

WILLIAM J. BAUER.