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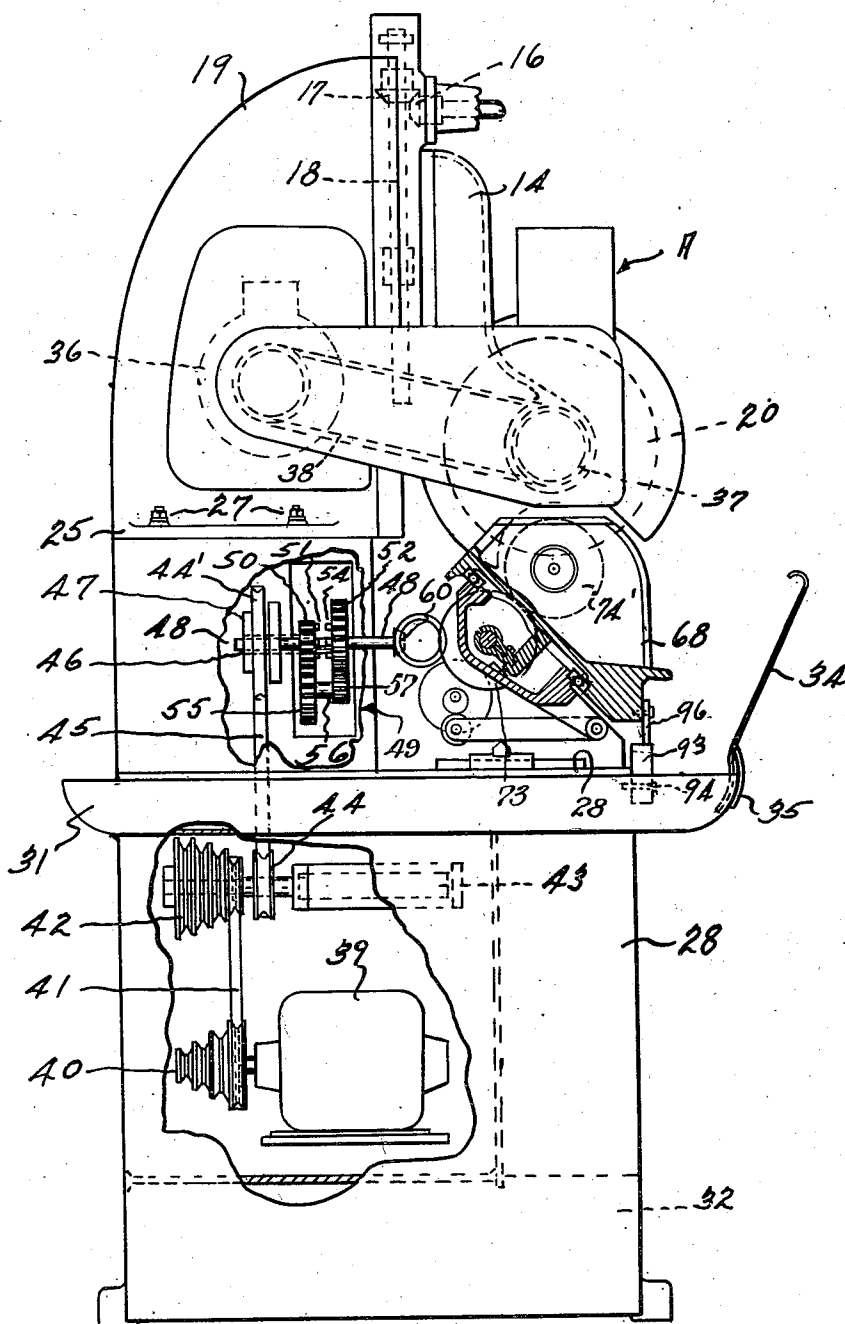
W. F. DALZEN

2,277,213

THREAD GRINDING MACHINE

Filed April 19, 1941

6 Sheets-Sheet 1



INVENTOR.

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March 24, 1947.

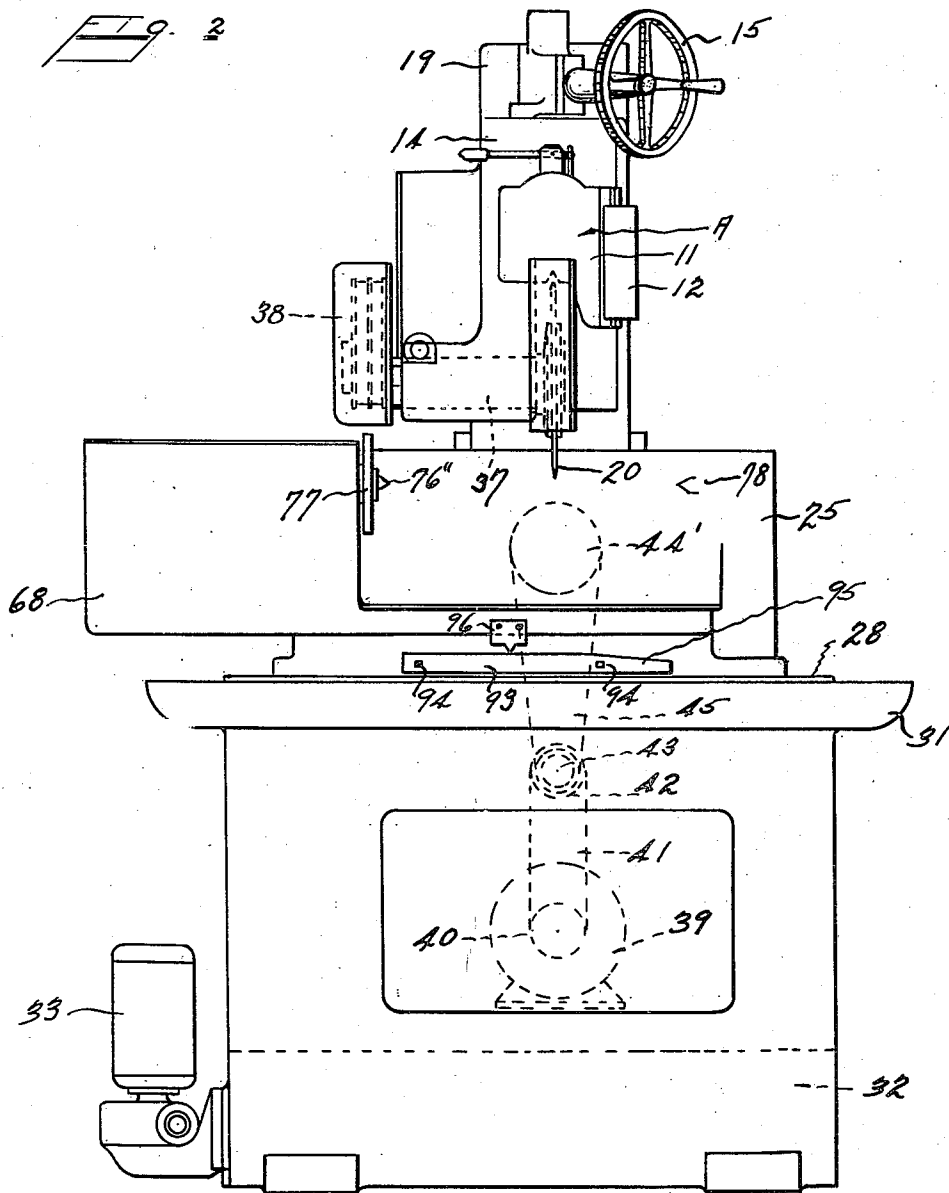
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THREAD GRINDING MACHINE

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6 Sheets-Sheet 2



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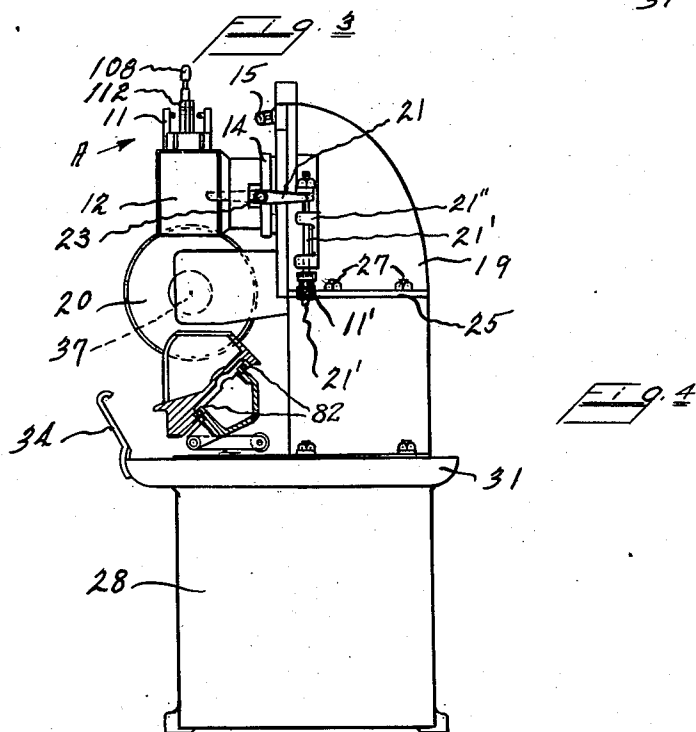
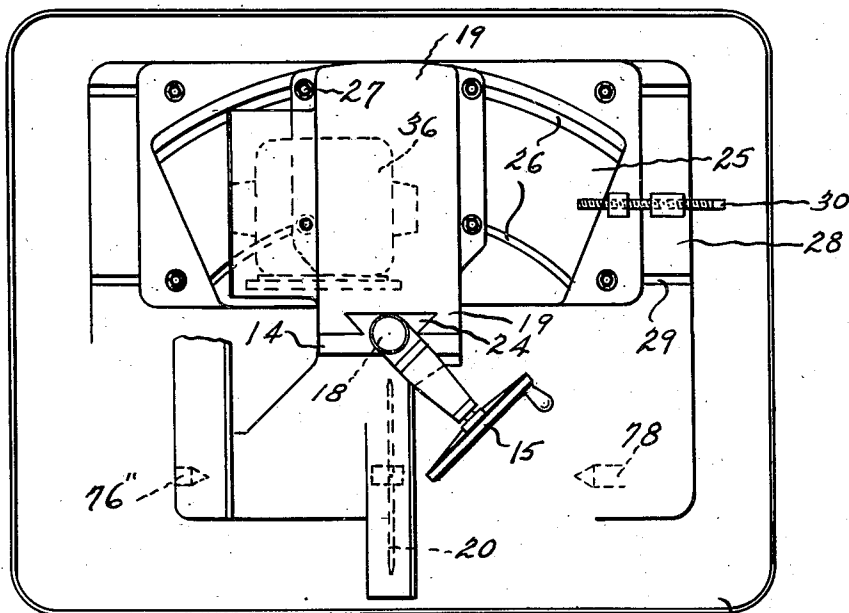
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THREAD GRINDING MACHINE

Filed April 19, 1941

6 Sheets-Sheet 3



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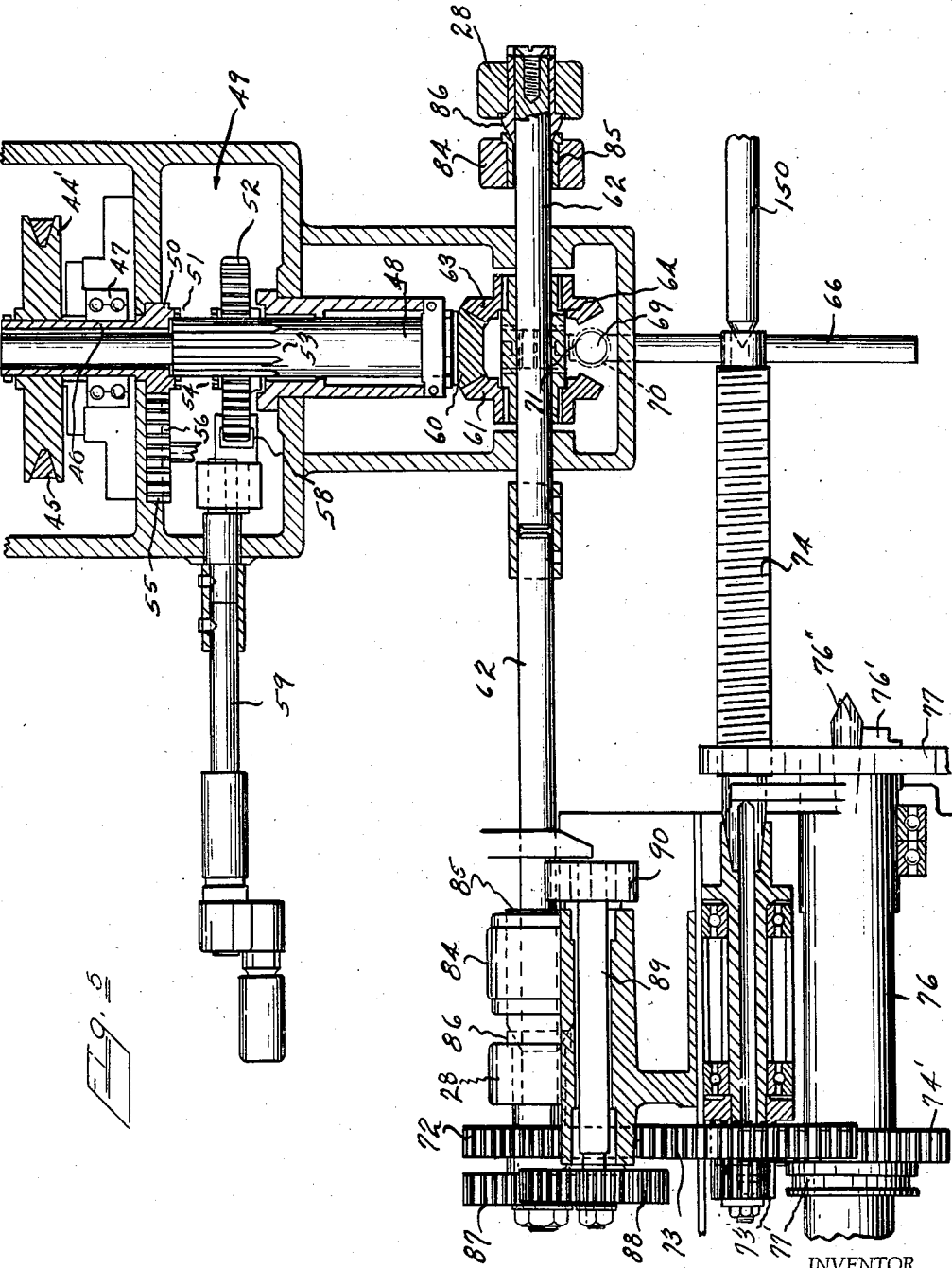
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THREAD GRINDING MACHINE

Filed April 19, 1941

6 Sheets-Sheet 4



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THREAD GRINDING MACHINE

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6 Sheets-Sheet 5

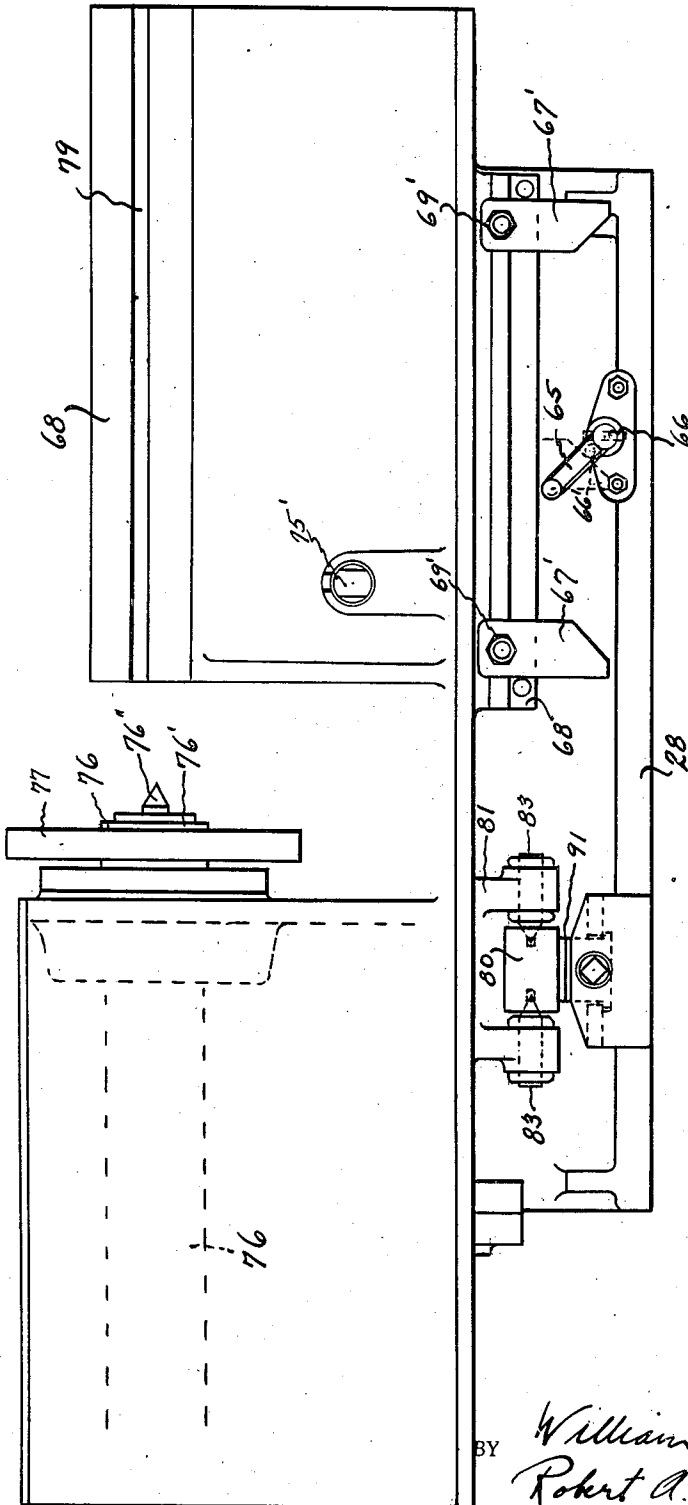


Fig. 5

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UNITED STATES PATENT OFFICE

2,277,213

THREAD GRINDING MACHINE

William F. Dalzen, Grosse Pointe, Mich.

Application April 19, 1941, Serial No. 389,263

27 Claims. (Cl. 51—95)

This invention relates to cutting and grinding machines and more particularly to thread grinding machines.

Hertofore devices of this type have been complicated by unnecessary machinery and working parts whereby said machines have been difficult and expensive to manufacture.

Due to the largeness and complicated nature of machines of this type the cost of maintenance has been higher and the accuracy thereof has been reduced due to wear on more working parts. It is therefore the object of this invention to provide a thread grinding machine which due to its simplicity is far more accurate than machines of this type heretofore constructed.

It is the object of this invention to provide a thread grinding machine of simple construction having a minimum number of parts, built at considerably less expense than heretofore expended for machines of this type.

It is the further object hereof to provide a thread grinding machine with a maximum production capacity in excess of similar machines of this type.

It is the further object of this invention to provide in a thread grinding machine and in combination therewith a novel grinding wheel form dresser adapted to produce various shaped surfaces in the edge of the abrasive grinding wheel for accurately grinding out various shapes of threads.

It is the further object hereof to provide in said dressing mechanism an auxiliary dressing attachment for producing a curved surface upon the outer peripheral edge of the abrasive grinding wheel.

It is the still further object herein to provide a simple cam attachment for said machine whereby radial relief may be obtained in making taps, reamers, or similar tools, or other articles where it is desired to vary the radial diameter at certain circumferentially spaced points upon a cut or ground surface.

It is the still further object of this invention to provide a novel run out slide whereby at the end of the threads and on the last thread, the work is gradually dropped away from the cutting wheel, giving a gradual run out from the root diameter of the thread to the extreme outside diameter of the part.

It is the still further object of this invention to provide a carriage supporting slide mechanism which may be angularly adjusted with respect to the horizontal for producing a taper in the work supported by said carriage. On the other hand,

it is the object herein to provide a carriage supporting slide mechanism having an irregularly shaped surface whereby an irregular shape may be reproduced in the work if desired.

5 It is the still further object hereof to provide means for supporting a rotatable grinding wheel above the work, together with means for raising and lowering said wheel with respect thereto.

10 It is the still further object herein to provide a vertically adjustable tail stock for supporting a rotatable work whereby a taper in either direction may be cut or ground thereon.

15 It is the still further object hereof to provide compensating means for raising and lowering the grinding wheel support and also the dresser with a proportional movement of the latter with respect to said support.

20 Other objects will be seen in the various arrangements of parts and combinations thereof as will be hereinafter described in connection with the appended drawings of which:

Figure 1 is a side elevational view of the thread grinding machine.

Figure 2 is a front elevational view of the same.

Figure 3 is a top plan view thereof.

Figure 4 is a side elevational view on the end opposite to that of Figure 1.

Figure 5 is a fragmentary plan view showing the transmission and reversing mechanism.

30 Figure 6 is a fragmentary elevational view of the carriage, and support therefor.

Figure 7 is a fragmentary elevational view of the rocker, cam, carriage, and reversing mechanism.

35 The above drawings illustrate merely preferable embodiments of the invention, it being expressly understood that it is not intended that the invention be limited thereby.

40 In the drawings, a grinding wheel dresser is generally indicated as A with its housing 11 vertically and reciprocally mounted within the support 12 with friction minimizing ball races or ways 13 interposed therebetween. Support 12 is joined to the vertically movable grinding wheel support or housing 14 and is adapted to move therewith.

45 Hand wheel 15 operating through gears 16 and 17 turns the threaded shaft or screw 18 which, supported by column 19, raises and lowers housing 14 and the abrasive grinding wheel 20 with respect to said column. The wheel dresser A and housing 11 are also raised and lowered by hand wheel 15 operating through the movable wheel support 14. It will be noted that wheel 50 20 may be a metal cutter where it would be de-

sirable for cutting softer metals than that of which the cutter consists.

Lever 21 has a lug on its end adapted to support the housing 11 of the dressing mechanism A. Said housing while resting upon the end of lever 21 is longitudinally and reciprocally journaled within the vertical support 12.

Said lever 21 is centrally pivoted at point 23 to the movable housing 14 which provides a movable support for the pivot point 23.

The other end of the lever 21 also has a lug thereon for adjustable engagement with respect to the column 19.

An adjustable relation is maintained between lever 21 and column 19 as the wheel supporting housing 14 is downwardly fed, whereby the dresser is permitted to properly engage the surface of the grinding wheel 20 in operative dressing position.

A compensation screw 21' is longitudinally disposed within a bracket member 21'' secured to the column 19. A washer is secured upon the end of screw 21' by a nut 23'; and the end of lever 21 is beneath said washer whereby a retaining means is provided preventing rotation of lever 21.

A calibrated bolt 11' is threadably disposed on the lower end of the compensating screw 21' and thereby provides a manually operable adjusting means permitting longitudinal adjustment of the compensating screw 21' whereby the lever 21 is correspondingly adjusted as desired.

Housing 14 slides relatively to column 19 with the dovetail 24, and as has been described, is adjustable with respect thereto by the hand wheel 15.

The wheel dressing mechanism is claimed in my divisional application Serial No. 423,517, filed December 18, 1941.

As seen in Figure 3 column 19 is angularly adjustable upon the upper bed 25 upon the arcuate T slots 26, with securing bolts 27 positioned through the lower portion of column 19 with the heads thereof slidably disposed within said T slots. By virtue of this arrangement the grinding wheel 20 may be angularly disposed to the desired angle of lead with respect to the work supported therebeneath in the manner hereinafter described.

In applicant's preferable embodiment, said column is adapted for arcuate adjustment through an arc of 45 degrees, which may be distributed proportionately on either side of center.

Bed 25 also longitudinally adjustable upon the base 28 is slidable with respect thereto by means of the T slots 29 therein. A threaded square headed shaft 30 is preferably employed for manually moving, by a suitable means, bed 25 with respect to said base member.

A basin or edging 31 is horizontally disposed upon the base member 28 for retaining the cooling oil after it has flowed from the work, whence it is conducted back to the fluid sump 32 within the base member 28.

A centrifugal pump 33 supported by said base member is in communication with the coolant sump 32, and is adapted to supply coolant through a suitable conduit to the point of engagement of the grinding wheel and work. From this point cooling fluid such as oil or other suitable composition descends to the basin 31 whence it returns to the sump 32.

As shown in Figure 1, a removable shield or splash guard 34 is provided removably secured

to the front portion of basin 31 by clips 35 for protecting the operator from splashing oil.

A motor 36 is supported within column 19 and is joined to the grinding wheel spindle 37 by any suitable belting 38 or other connecting means with suitable means such as step pulleys employed for varying the speed of said spindle.

Another motor 39 is supported within base member 28 with a plurality of step pulleys 40 joined thereto for operable engagement selectively through belt 41 with a plurality of step pulleys 42 upon an idler 43 which in turn is joined by suitable pulleys 44 and 44' and a belt 45 for rotating sleeve 46 within a suitable bearing support 47. By virtue of said pulleys a plurality of speeds for said sleeve may be obtained when desired. However, it will be noted that other variable means may be employed for connecting motor 39 with rotatable sleeve 46. Sleeve 46 operates drive shaft 48 with a speed-up transmission 49 interposed therebetween, said shaft being disposed concentrically within said sleeve.

Referring to Figures 1 and 5 a gear 50 secured upon sleeve 46 and rotatable therewith has on its outside edge a clutch member 51. Shaft 48 has a gear 52 thereon rotatable therewith but adapted for a reciprocable sliding movement thereon over splines 53 in said shaft. The outside surface of gear 52 also has a clutch member 54 adapted for cooperating engagement with clutch member 51 when gear 52 is moved to the left in the manner hereinafter described. So moved, it is seen that sleeve 46 and drive shaft 48 move together with no speed up.

A speed-up gear 55 on shaft 56 is in mesh with gear 50 for operating gear 57, on the other end of said shaft. With gear 52 moved to the right it is in engagement with gear 57 whereby a speed-up is obtained between sleeve 46 and drive shaft 48.

The means employed for longitudinally sliding gear 52 upon drive shaft 48 consists of a bifurcated stirrup or forked member 58 adapted to loosely engage the edges of gear 52 for sliding the same upon shaft 48 for engagement and disengagement of clutch members 51 and 54.

Forked member 58 is secured on the end of a manually actuated shaft 59 providing operative control for the above described transmission. In one position of gear 52 as at the left the connection between sleeve 46 and shaft 48 is direct. With gear 52 moved to the right by shaft 59 sleeve 46 is indirectly joined to shaft 48 through the speed-up transmission gears 50, 55, 57 and 52.

Gear 60 on the end of drive shaft 48 is in engagement with gear 61, with the latter loosely journaled upon shaft 62 and rotatable independently thereof. A reverse gear 63 in spaced relation to gear 61 is also loosely journaled around shaft 62 and movable independently thereof, but meshing with gear 60.

A clutch member 64 is slidably disposed upon shaft 62, movable therewith but adapted to positions of engagement with either gear 61 or gear 63 or in a neutral position therebetween.

Said clutch 64 is therefore adapted to turn with either gear 61 or 63 whereby shaft 62 is turned in one direction or the reverse thereof.

The position of clutch 64 upon shaft 62 is regulated by a manually actuated latch or handle 65 disposed in the front of the thread grinding machine and adapted for movement to the left and to the right.

A shaft 66 is joined to said handle and has on its end a gear 67 which is in mesh with a similar

gear 68' for turning another shaft 69. A gear 70 is on the end of shaft 69 and cooperatively engages clutch 64 by means of a rack gear 71 thereon.

Consequently movement of handle 65 causes a corresponding movement of clutch 64 for disengaging drive shaft 62 from drive shaft 48, and for regulating the movement of said drive shaft 62 in one direction or the other. This manual control also regulates the reciprocable movement of the work supporting spindle and also the rotatory movement of the work with respect to the grinding wheel 20.

Referring to Figures 9 and 7 it is seen that the manual control 65 has a roller member 66' adapted to be engaged by the vertically disposed stops 67' secured to the reciprocable work support carriage 68. It will be noted that these stops 67' are adapted to longitudinal adjustment and are secured to the movable carriage by suitable securing means 69'.

In operation, with said carriage moving in one direction, when one of said stops engages the roller 66' on the handle 65 said handle is turned to a neutral position which automatically disengages the drive shaft 62 by means of the clutch mechanism 64 hereinbefore described.

Shaft 62 has near its end a gear 72 in mesh with gear 73 for providing rotative motion of the lead screws 74 to which it is attached. The opposite end of said lead screw is supported by a longitudinally adjustable tailstock 150' thereby permitting the use of different lengths of lead screws if required.

It will be noted that the lead screw is adapted to cause reciprocable movement of a work supporting carriage 68 with respect to the rotative grinding wheel 20, and is also adapted to cause rotation of the work itself in the manner hereinafter described.

A suitable nut 75, wedged up against the under side of the reciprocable carriage 68 by means of a manually actuated eccentric pin 75', threadably engages said lead screw 74 causing reciprocable sliding movement of carriage 68 with the direction thereof governed by the direction of movement of said lead screw. It is seen that merely by turning the eccentric pin 75' that nut 75 carrying lead screw 74 is securely locked in place. More particularly a lug 150 downwardly depends at right angles from the carriage 68, and has a longitudinal slot 151 therethrough. The nut 75 for the lead screw 74 is adapted to have its bottom portion snugly disposed within slot 151. A stop plate 152 is suitably secured to lug 150 on one side of slot 151 adjacent one edge of nut 75 limiting movement thereof with respect to lug 150 and carriage 68.

The eccentric pin 75' engages the opposite edge of nut 75 wedging the same, when operative, against the stop plate 152. Thus the nut 75, maintained securely against the underside of carriage 68 by lug 150 and eccentric pin 75 is adapted to reciprocably actuate said carriage upon rotation in one direction or the other of lead screw 74. It will be noted that suitable means are employed as hereinabove described whereby the direction of motion thereof is manually or automatically reversed or disengaged.

Reversal of the direction of movement of lead screw 74 in turn results in reversal of the longitudinal movement of the work supporting carriage 68 and at the same time reversal of the direction of rotative movement of the work.

Gear 73 is also in mesh with gear 74' for turn-

ing the hollow work spindle 76 which is provided with a work driving plate 77, adapted to cooperatively engage a suitable work driver which is secured to the work, for facilitating turning of the same with respect to the grinding wheel 20.

A removable tapered sleeve 76' is secured within spindle 76 for supporting the work journaling center 76''. It will be understood that said sleeve and center are removable to permit the journaling of a long piece of work concentrically within the hollow spindle 76 if necessary. Other suitable work securing means may then be employed for retaining and supporting the work.

Longitudinal movement of the work supporting carriage 68 coincides with the rotary movement of the work supporting spindle 76 in one direction by means of the intermeshing gears 73 and 74'.

It may be desirable, however, that for such movement of the carriage 68 that the work rotate in the opposite direction. To accomplish this a removable idler gear 73' supported by a suitable bracket 73'' is in mesh with gear 73.

A manually actuated gear shifting fork 74'' is adapted to engage the annularly recessed gear shifting means 77' which is secured to the spindle driving gear 74'. Movement of fork 74'' causes gear 74' to move longitudinally upon spindle 76 on a suitable keyway or splines bringing said gear into mesh with the idler gear 73'. So connected, the rotary motion of spindle 76 is thereby reversed independently of the work carriage 68, and without changing the lead screw.

In this connection a tail stock 78 is also employed for supporting the work at its opposite end. Said tail stock adjustable horizontally upon a keyway 79 on the carriage 68 for different lengths of work, is also adjustable vertically by suitable means, as for instance, a screw with a dovetail connection between said tail stock and support. Thereby with vertical adjustment of said tail stock a taper in either direction may be put upon the work if desired.

Referring again to work carriage 68, as in Figures 1 and 7 it is seen that the same is angularly supported with respect to the sub-table 81. By interposing ball races or ways 82 along the entire engaging surfaces of said sub-table and work supporting carriage, friction therebetween is minimized providing a free acting reciprocable movement for the latter.

Sub-table 81 pivotally secured to the lever 80 at points 83 is angularly disposed and pivotally supported at its upper edge by hinge members 84 with the bearings 85 therefore loosely disposed around the shaft 62, and supported by the drive shaft bearings 86 which are in turn supported in the base 28 of the thread grinding machine. Thus it is seen that the sub-table 81 is pivotally supported about the axis of the drive shaft 62 as shown in Figures 8 and 10.

Gear 87 is joined to shaft 62 adapted to mesh with another gear 88 for operating a cam shaft 89. Cam 90 secured upon the end of said shaft is adapted to produce a reciprocable rocking movement of the sub-table 81. This movement is employed wherever it is desired to obtain radial relief in the grinding of taps, reamers, or similar tools. In other words, by this device the thread channel put on a tap or other tool may have a variable radius at certain circumferentially spaced points.

The cam 90 is adapted to engage the upper surface of a lever 80 at one end thereof. A ful-

crum 91 is provisioned beneath lever 80, and is adapted to slidable adjustment longitudinally of the length of said lever. The other end of the lever 80 has pivoted thereto at point 83 the sub-table 81.

It is seen that impulses are given by cam 90 as it is rotated, whereby lever 80 is intermittently tilted upon its fulcrum 91. The other end of the lever pivoted to said sub-table 81 thereby produces an intermittent rocking motion in the work supporting carriage 68 on which is disposed the work support 76, and also the tail stock 78.

Fulcrum 91 is slidably adjustable with respect to a calibrated scale 92 under the lever whereby different degrees of movement are obtained for the sub-table 81. It will be noted that the cam shaft 89 is adapted for disengagement with gear 88 whenever its use is not required.

A run-out slide mechanism is herein provided whereby at the end of the threads and on the last thread the work carriage 68 and sub-table 81 and the work are gradually dropped away from the cutting wheel, giving a gradual run-out of the thread channel from the root diameter of the thread to the extreme outside diameter of the work.

This eliminates the abrupt stoppage of the thread as has been the case heretofore. This point of stoppage has been a bending point between the threaded portion and the body portion, and as a result when breakage occurred, it occurred in this point. By eliminating this abrupt stoppage of the thread and running the same out gradually to the extreme diameter of the part, bending is distributed over a greater length of the work.

The run-out slide mechanism as illustrated in Figure 2 consists of a longitudinally disposed supporting member 93 adjustably secured on the front of the base member 28 at points 94 with one end of said support angularly cut away as at 95. Guide means 96 depending downwardly from the reciprocable carriage 68 cooperatively register with the top surface of the supporting slide member 93 and support said carriage with respect thereto.

It will be noted that by adjustment of securing means such as screws at points 94, member 93 may be angularly disposed with respect to the horizontal. By so doing a gradual taper may be obtained throughout the length of the work if desired.

On the other hand member 93 may have an irregularly shaped upper surface upon which guide 96 will register. Consequently irregularly shaped surfaces may be reproduced in the work supported by the movable carriage 68.

It will be noted further in this connection that when grinding taps or reamers employing the use of the cam attachment 90, heretofore described, that the run-out slide mechanism is disengaged. On the other hand when using the run-out slide 93 and support 96 the cam attachment 90 is disconnected.

As the work and table are moved to the right with the wheel 20 in grinding engagement with the rotated work, the guide 96 follows the top surface of the slide 93. When said guide reaches the inclined portion 95 it is seen that the work support 68 is gradually dropped away from the grinding wheel 20 which results in a gradual run-out of the threads cut from the root diameter to the outside diameter of the work.

In grinding out threads upon a rotated work piece it will be seen that the size and number of

threads per inch varies with each job. Consequently the correct pitch is obtained by making the lead screw 74 and nut 75 readily removable and interchangeable with others of different pitches. Therefore it is seen that the thread grinding device described herein has a multiplicity of uses and its versatility and adaptability to various types of jobs is apparent.

It will be noted from the above description that the thread grinding mechanism provides driving means for reciprocating the work supporting carriage 68 in the form of a lead screw 74 and also at the same time provides intermeshing means 73 and 74' for rotating the work throughout reciprocable movement thereof.

From time to time the grinding wheel 20 becomes worn requiring a dressing operation; or on the other hand it may be desired to vary the form of the cutting edge thereof for providing a particular shape of thread.

For these purposes a wheel dresser A is employed having a housing 11 vertically and reciprocally mounted within the support 12 as above described.

The above dressing mechanism is a form dresser adapted to obtain a plurality of shapes of peripheral edge on the abrasive grinding wheel 20 depending upon the form of thread desired.

Having described my invention reference should now be had to the claims which follow for determining the scope of this invention.

I claim:

1. A thread grinding machine comprised of a base, a slide longitudinally adjustable thereon, an angularly adjustable column upon said slide, a rotatable grinding wheel adjustably supported upon said column, a longitudinally reciprocable carriage supported upon said base, a work supporting and rotating spindle upon said carriage with an operating gear joined to said spindle, a reversible power shaft having a gear thereon, a rotatable lead screw in threaded engagement with said carriage, and having a gear joined thereto intermeshing with said power shaft gear and said spindle operating gear.

2. In a thread grinding machine the combination, a base, a reciprocable work supporting and rotating carriage disposed thereon, a vertically adjustable support on said base, a rotatable thread grinding wheel carried by said support, a wheel dresser adjustably carried by said support, and means pivoted to said support with said dresser riding upon one end thereof and the other end adjustably secured to said base, whereby movement of said support causes a corresponding proportional movement of said dresser.

3. In a thread grinding machine having a carriage support, a longitudinally reciprocable carriage slidably mounted upon said support with a spindle thereon for rotatably supporting a workpiece, and also having a rotatable grinding wheel adjustably supported adjacent said workpiece; a drive shaft, a cam operable from said drive shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, and a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said carriage support relative to said grinding wheel is imparted.

4. In a thread grinding machine having a pivotal carriage support, a longitudinally reciprocable carriage slidably mounted upon said support with a spindle thereon for rotatably supporting a workpiece, and also having a rotatable

grinding wheel adjustably supported adjacent said work-piece; a drive shaft, a cam operable from said drive shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, and a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said carriage support relative to said grinding wheel is imparted, said fulcrum being longitudinally adjustable with respect to said lever for regulating the degree of said radial motion.

5. In a thread grinding machine having a base member and a drive shaft journaled therein and also a grinding wheel; a carriage support pivotally hinged upon its upper edge to said drive shaft, a reciprocable carriage upon said support with a spindle thereon for rotatably supporting a work, and a rotatable cam actuated by said drive shaft and engageable with said carriage support for intermittently imparting a radial motion thereto around said drive shaft axis, relative to said grinding wheel.

6. A thread grinding machine comprised of a base, a slide longitudinally adjustable thereon, an angularly adjustable column upon said slide, a housing longitudinally adjustable upon said column, a grinding wheel journaled thereby, a longitudinally reciprocable carriage supported upon said base, a work supporting and rotating spindle upon said carriage, a grinding wheel dressing mechanism slidably disposed upon said housing, and compensating means pivoted to said housing with one end adjustably secured to said column and the other end supporting said dresser mechanism, whereby upon adjustment of said housing a proportional adjustment is obtained between said dressing mechanism and said grinding wheel.

7. A thread grinding machine comprised of a base, an angularly adjustable column upon said base, a housing longitudinally adjustable upon said column, a grinding wheel journaled thereby, a grinding wheel dressing mechanism slidably and vertically disposed upon said housing above said grinding wheel, and compensating means pivotally mounted on said housing with one end adjustably secured to said column, and its other end providing a support for said dressing mechanism, whereby upon feeding adjustment of said housing, said dresser is permitted to descend by its own weight for obtaining a proportional adjustment between said dresser and said grinding wheel.

8. A thread grinding machine comprised of a base, an angularly disposed sub-table pivotally mounted along one of its longitudinal edges above said base, a longitudinally reciprocable work supporting and rotating carriage upon said sub-table, a rotatable grinding wheel adjustably supported above said carriage, an irregularly shaped slide member adjustably secured to said base, a guide member depending from said carriage for supporting the same upon said slide, whereby the carriage throughout longitudinal movement is adapted to be pivoted about the longitudinal edge of said sub-table for transverse movement relative to said grinding wheel, following the contour of said slide member.

9. In a thread grinding machine having a base, a rotatable grinding wheel adjustably supported on said base, and a drive shaft; an angularly disposed carriage support pivotally journaled upon its upper edge to said drive shaft, a longitudinally reciprocable workpiece supporting and rotating carriage upon said support, an irregu-

larly shaped slide member adjustably secured to said base, a guide member depending from said carriage for supporting the same upon said slide, whereby the carriage throughout longitudinal movement is adapted to be pivoted about the longitudinal edge of said carriage support for transverse movement relative to said grinding wheel, following the contour of said slide member.

10. In a thread grinding machine having a longitudinally reciprocable carriage with a spindle therein for rotatably supporting a work-piece, and also having a rotatable grinding wheel adjustably supported above said work; a power source, a plurality of pulleys for varying the speed of a power shaft, a drive shaft for controlling the movement of said carriage and said spindle, an angularly disposed carriage support pivotally hinged along its longitudinal edge to said drive shaft, and a speed-up transmission between said power shaft and said drive shaft for manually regulating the speed of the latter.

11. In a thread grinding machine having a longitudinally reciprocable carriage with a spindle therein for rotatably supporting a work-piece, and also having a rotatable grinding wheel adjustably supported above said work; a drive shaft, a rotatable lead screw operated by said shaft for actuating said carriage, an angularly disposed carriage support pivotally and hingedly secured along one of its longitudinal edges to said power shaft, means interconnecting said spindle with said lead screw, a reversing idler interconnected with said lead screw, and manually actuated means for interconnecting said reversing idler with said spindle, whereby the direction of rotation of the work is reversed without effecting the direction of feed of the carriage.

12. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled along one of its longitudinal edges to said power shaft, a longitudinally reciprocable work rotating and supporting carriage mounted upon said support, and a plurality of friction minimizing means interposed between said carriage and said support.

13. In a thread grinding machine having a drive shaft and an angularly disposed carriage support pivoted along its longitudinal edge to said drive shaft, a longitudinally reciprocable carriage with a spindle thereon for rotatably supporting a workpiece, and also having a rotatable grinding wheel adjustably supported adjacent said work; a drive shaft, a cam shaft operable from said drive shaft, a cam on said cam shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, and a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said carriage support about said drive shaft relative to said grinding wheel is imparted.

14. In a thread grinding machine having a drive shaft and an angularly disposed carriage support pivoted to said shaft; a longitudinally reciprocable carriage with a spindle thereon for rotatably supporting a workpiece, and also having a rotatable grinding wheel adjustably supported adjacent said work; a drive shaft, a cam operable from said drive shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, and a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said

carriage support about said drive shaft relative to said grinding wheel is imparted, said fulcrum being longitudinally adjustable with respect to said lever for regulating the degree of said radial motion.

15. A thread grinding machine comprised of a base, an angularly adjustable column thereon, a rotatable grinding wheel adjustably supported upon said column, a longitudinally reciprocable carriage supported upon said base, a work supporting and rotating spindle upon said carriage, with an operating gear joined to said spindle, a reversible power shaft having a gear thereon, a rotatable lead screw in threaded engagement with said carriage, and having a gear joined thereto intermeshing with said power shaft gear and said spindle operating gear, a reversing idler interconnected with said lead screw, and manually actuated means for interconnecting said reversing idler with said spindle whereby the direction of rotation of the work is reversed without effecting the direction of feed of the carriage.

16. In a thread grinding machine having a base and an adjustable grinding wheel; a carriage support upon said base, a longitudinally reciprocable work rotating and supporting carriage slidably mounted upon said support, and having depending therefrom a recessed shoulder, and interiorly threaded nut, removably disposed within said recess, a stop plate secured to said shoulder on one end of said recess for limiting movement of said nut therein, a manually actuated eccentric pin rotatably journaled through said carriage with its eccentric surface engaging said nut, on the side opposite said stop plate, and a rotatable lead screw journaled through said nut for causing reciprocable movement of said carriage with respect to said support.

17. A thread grinding machine comprised of a base, an angularly adjustable column thereon, a rotatable grinding wheel adjustably supported on said column, a reciprocable carriage upon said base, a work supporting and rotating spindle upon said carriage, with an operating gear joined to said spindle, a reversible power shaft having a gear thereon, a rotatable lead screw in threaded engagement with said carriage, and having a gear joined thereto intermeshing with said power shaft gear and said spindle operating gear.

18. In a thread grinding machine the combination, a base, a reciprocable work supporting and rotating carriage disposed thereon, a column upon said base, a vertically adjustable support upon said column, a rotatable thread grinding wheel carried by said support, a wheel dresser adjustably carried by said support, and means pivoted to said support with said dresser riding upon one end thereof and the other end adjustably secured to said column, whereby movement of said support causes a corresponding proportional movement of said dresser.

19. In a thread grinding machine having a carriage support, a longitudinally reciprocable carriage slidably mounted upon said support with a spindle thereon for rotatably supporting a work-piece, an operating gear joined to said spindle, and also having a rotatable grinding wheel adjustably supported adjacent said work-piece; a reversible drive shaft with a plurality of gears thereon, a rotatable lead screw in threaded engagement with said carriage, and having a gear joined thereto intermeshing with said power shaft gear and said spindle operating gear, a disen-

gageable cam operable from said drive shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, and a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said carriage support relative to said grinding wheel is imparted.

20. In a thread grinding machine having a pivotal carriage support, a longitudinally reciprocable carriage slidably mounted upon said support with a spindle thereon for rotatably supporting a work-piece, and also having a rotatable grinding wheel adjustably supported adjacent said work-piece; a drive shaft, a cam operable from said drive shaft, a lever pivoted on one end to said carriage support, and cooperatively engaging said cam on its other end, a fulcrum intermediate the ends of said lever, whereby an intermittent radial motion of said carriage support relative to said grinding wheel is imparted, said fulcrum being longitudinally adjustable with respect to said lever for regulating the degree of said radial motion, and calibrated means adjacent said fulcrum for predetermining the position thereof.

21. In a thread grinding machine having a base member and a drive shaft journaled therein and also a grinding wheel; a carriage support pivotally hinged to said drive shaft, a reciprocable carriage upon said support with a spindle thereon for rotatably supporting a work-piece, and a rotatable cam engageable with said carriage support for intermittently imparting a radial motion thereto around said drive shaft axis, relative to said grinding wheel.

22. In a thread grinding machine having a longitudinally reciprocable carriage with a spindle thereon for rotatably supporting a work-piece, and also having a rotatable grinding wheel adjustably supported above said work-piece; a drive shaft, a rotatable lead screw operated by said shaft for actuating said carriage, an angularly disposed carriage support pivotally and hingedly secured to said power shaft, means interconnecting said spindle with said lead screw, a reversing idler interconnected with said lead screw, and manually actuated means for interconnecting said reversing idler with said spindle, whereby the direction of rotation of the work-piece is reversed without effecting the direction of feed of the carriage.

23. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled to said power shaft, a longitudinally reciprocable work rotating and supporting carriage mounted upon said support, and a plurality of friction minimizing means interposed between said carriage and said support.

24. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled to said power shaft, and a longitudinally reciprocable work rotating and supporting carriage mounted upon said support.

25. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled to said power shaft, a longitudinally reciprocable work rotating and supporting carriage mounted upon said support, and manually operable means for reversing the direction of rotation of said power shaft.

26. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled to said power shaft, a longitudinally reciprocable work-piece 5 rotating and supporting carriage slidably mounted upon said support, manually operable means for reversing the direction of movement of said carriage, and means in spaced relation secured to said carriage for actuating said manually operable reversing means to automatically disen-

gage the drive shaft at the end of a predetermined stroke.

27. In a thread grinding machine having a base, an adjustable grinding wheel, and a power shaft; an angularly disposed carriage support pivotally and hingedly journaled to said power shaft, a longitudinally reciprocable work rotating and supporting carriage mounted upon said support, and manually operable means for disengag- 10 ing said power shaft.

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