J. BATH AND R. H. C. GRUNEWALD.

THREAD GRINDER.

APPLICATION FILED SEPT. 18, 1920.

1,438,682.

Patented Dec. 12, 1922.

6 SHEETS—SHEET 1.

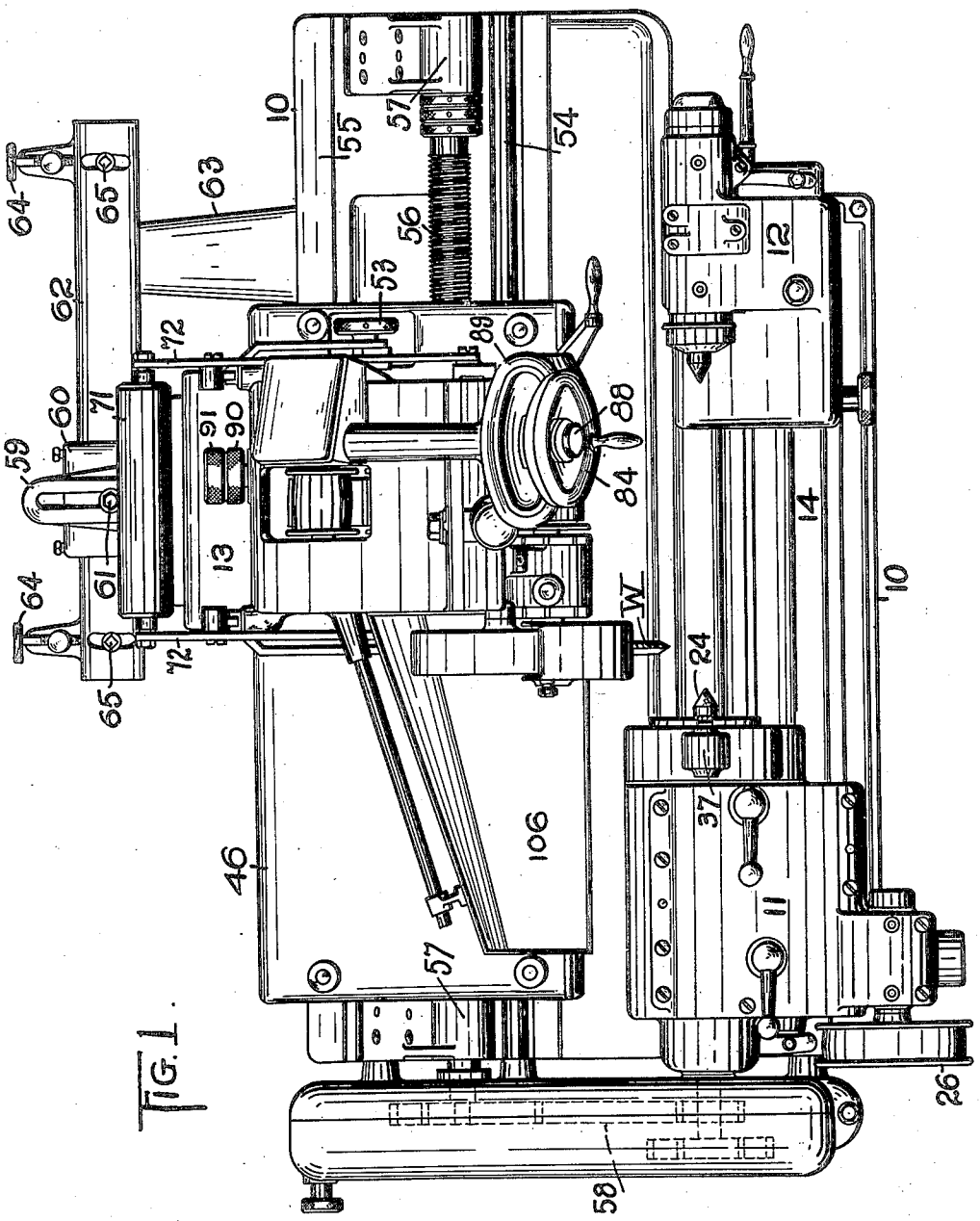


FIG. 1.

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6 SHEETS—SHEET 2.

FIG. 2.

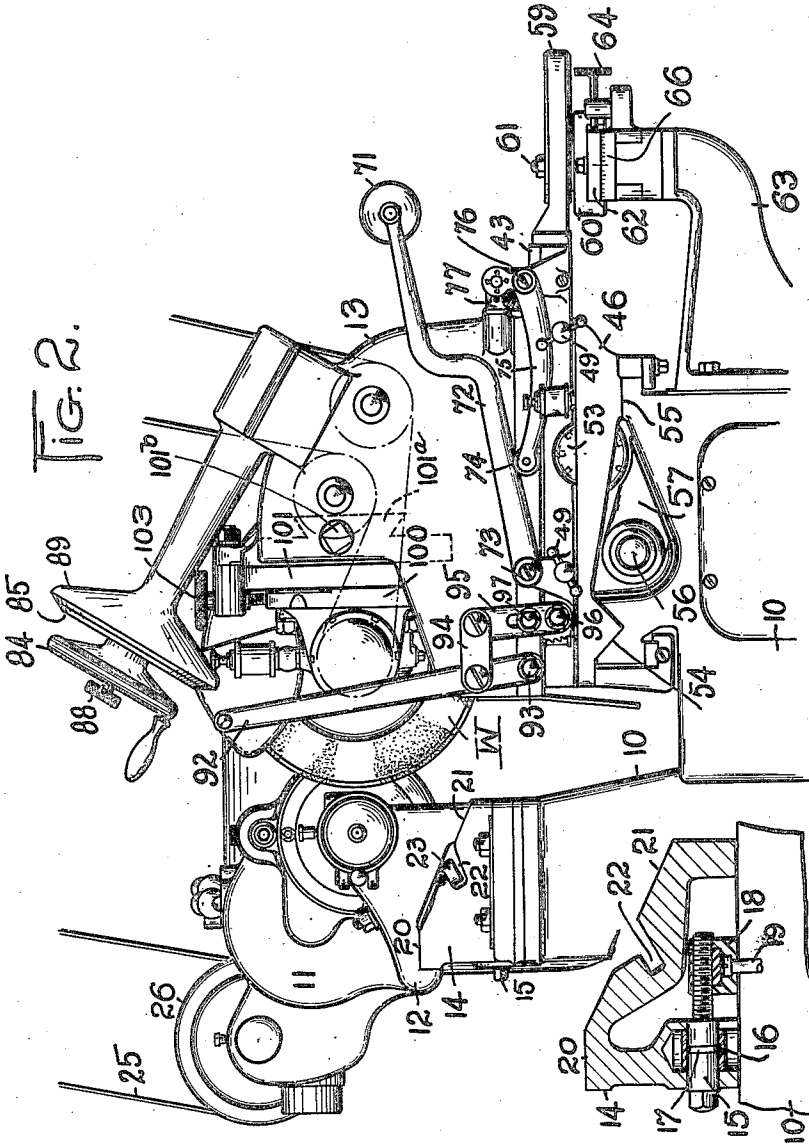


FIG. 9.

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6 SHEETS—SHEET 3.

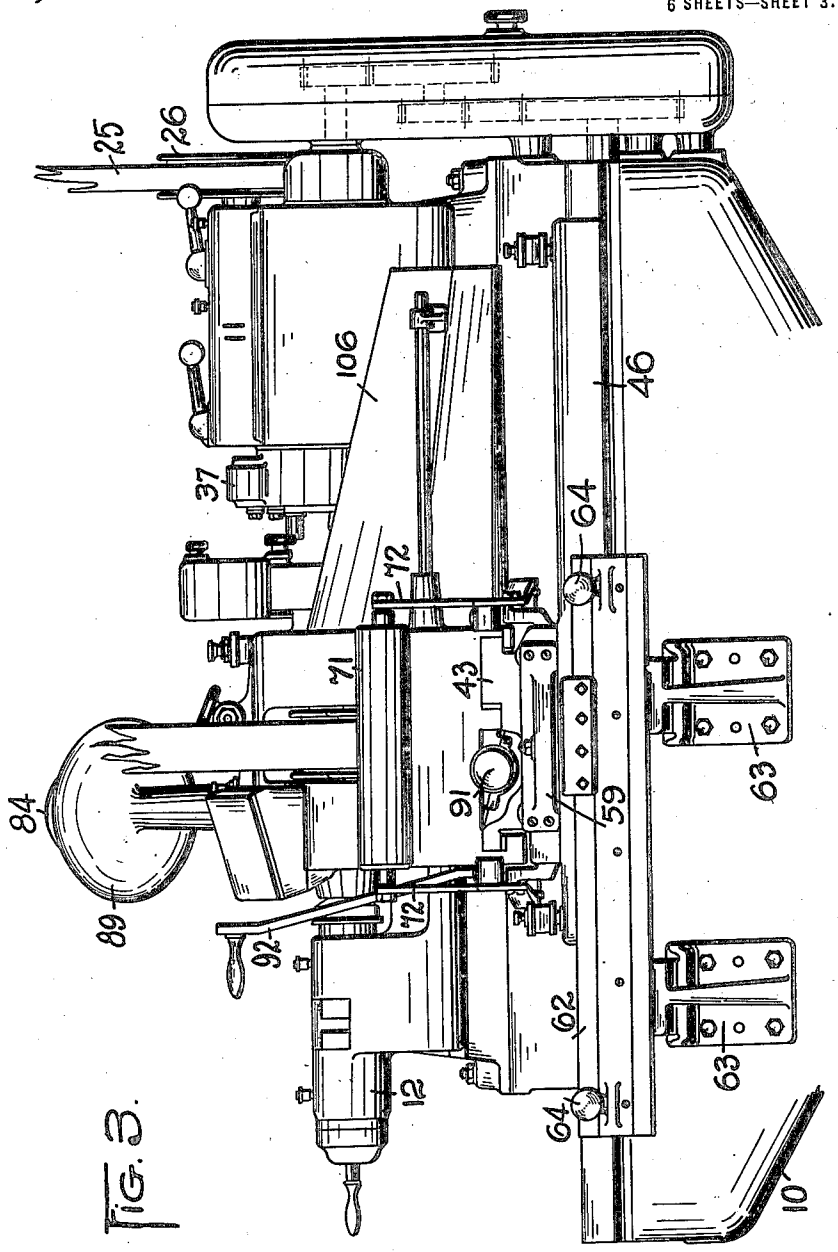


FIG. 3.

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6 SHEETS—SHEET 4.

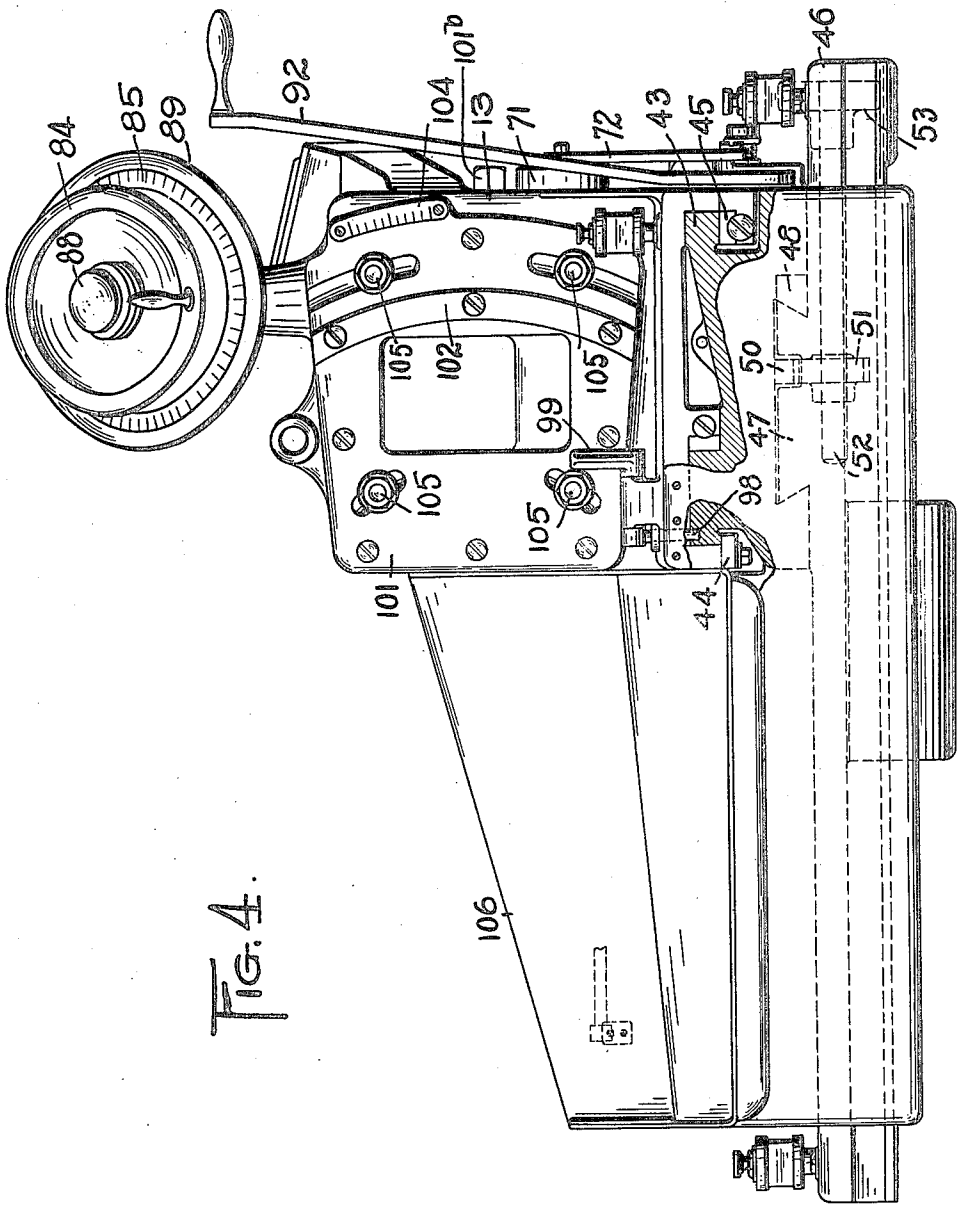


FIG. 4.

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6 SHEETS—SHEET 5.

FIG. 5.

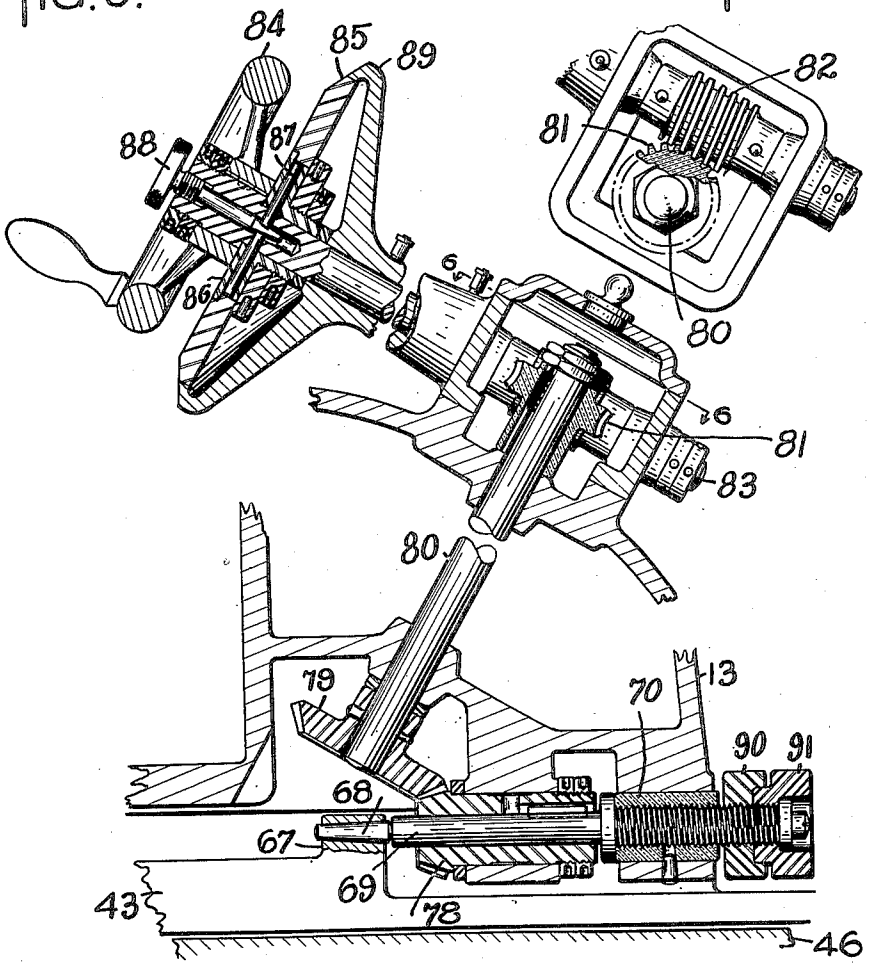


FIG. 6.

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6 SHEETS—SHEET 6.

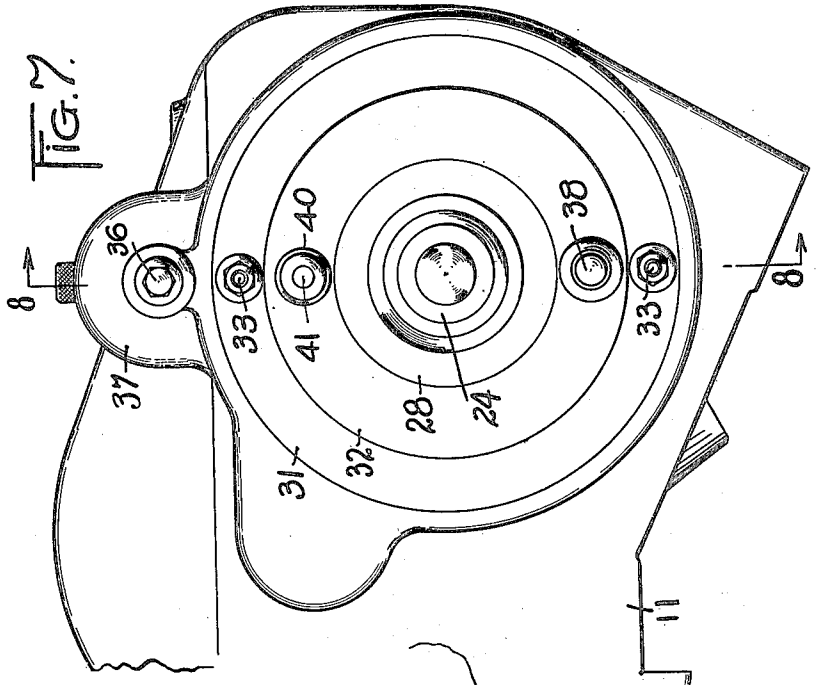


FIG. 7.

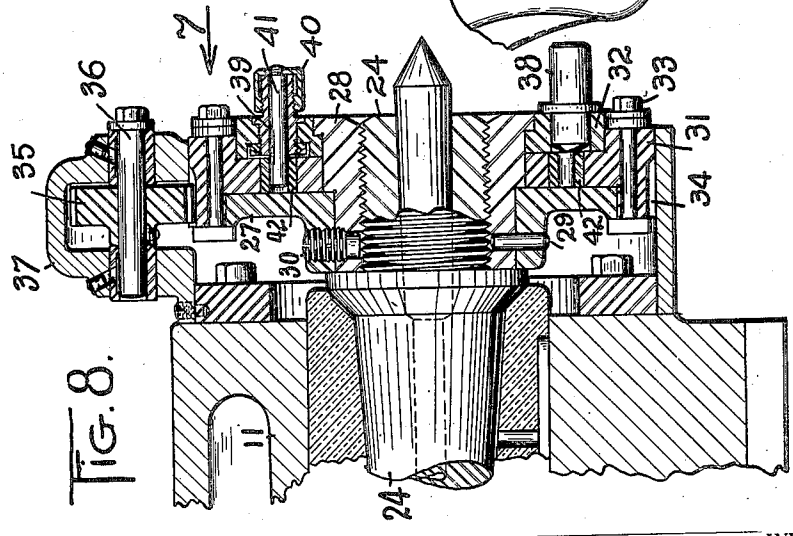


FIG. 8.

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Patented Dec. 12, 1922. 1,438,682

UNITED STATES PATENT OFFICE.

JOHN BATH AND ROBERT H. C. GRUNEWALD, OF WORCESTER, MASSACHUSETTS, ASSIGNORS TO JOHN BATH & CO. INC., A CORPORATION OF MASSACHUSETTS.

THREAD GRINDER.

Application filed September 18, 1920. Serial No. 411,243.

To all whom it may concern:

Be it known that we, JOHN BATH and ROBERT H. C. GRUNEWALD, citizens of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Thread Grinder, of which the following is a specification.

This invention relates to a grinding machine particularly designed for grinding the threads of taps and similar articles after the same have been through the hardening operation. This operation, even when most carefully performed, unavoidably introduces errors in the pitch of the threads or in the axial alignment of the article, rendering it necessary to grind the threads after hardening where great accuracy is required.

It is the object of our invention to provide an improved machine for performing such grinding operations, by the use of which thread grinding may be carried on as commercially practical operation. In accordance with this general object, we have devised a thread grinder in which the work driving spindle head is fixed in position during the grinding operation, while the grinding wheel is mounted on a wheel carriage moved longitudinally by an accurate lead screw.

Important features of our invention relate to the provision of means for adjusting the grinding wheel toward and from the work, for accurately indexing its position, to provision for withdrawing the wheel from the work independently of said adjusting means, to the provision of means for adjusting the vertical angle of the wheel shaft relative to the work, and to means for moving the wheel longitudinally of the work and at any desired angle to the axis thereof.

We have also provided improved devices for protecting the wheel carriage bearings from water and dirt, and a novel face plate attachment by which the work may be quickly and accurately adjusted angularly.

Our invention further relates to arrangements and combinations of parts to be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of our invention is shown in the drawings in which—

Fig. 1 is a plan view of our improved machine;

Fig. 2 is a right hand side elevation thereof;

Fig. 3 is a rear elevation of the machine;

Fig. 4 is a front elevation of the wheel carriage with the wheel shaft and bearings removed;

Fig. 5 is a sectional side elevation of the wheel carriage;

Fig. 6 is a plan view of certain parts taken along the lines 6—6 in Fig. 5;

Fig. 7 is a right hand elevation of the work supporting spindle head;

Fig. 8 is a partial sectional elevation of the spindle head taken along the line 8—8 in Fig. 7, and

Fig. 9 is a detailed sectional elevation of the work supporting table.

Referring to the drawings, we have shown a thread grinder comprising a base 10, a work supporting spindle head 11, a tail stock 12 and a wheel head 13. The spindle head 11 and tail stock 12 are secured to a work table 14 (Fig. 2), supported by the base 10. The table 14 is pivotally connected near its left hand end to the base 10, and at its right hand end has a bolt and slot connection therewith, thus permitting slight angular adjustment of the table 14 without noticeably effecting the gear drive of the spindle.

The table may be angularly adjusted by the mechanism shown in Fig. 9, comprising an adjusting screw 15 having a bearing in the table 14 and held from longitudinal movement therein by a pin 16 projecting into a groove 17 in the body of the screw 15. The rear end of the screw is threaded into a nut 18 pivotally secured to the base 10 by a stud 19.

The table 14 is made with the cross section shown in Fig. 9 and is provided with bearing surfaces 20 and 21 for the spindle head and tail stock. A recess 22 receives the end of the hook bolt 23 (Fig. 2) by which the tail stock is clamped in position.

The spindle head is commonly fixed in its longitudinal position and may be secured to the table in any suitable manner. The spindle 24 (Fig. 8) is preferably driven by a belt 25 (Fig. 2) through a pulley 26 and change gear mechanism (not shown) by which the pulley shaft is connected to the spindle. The details of the spindle drive form no part of our invention.

Special provision is made, however, for

angularly adjusting the work relatively to the spindle 24. A flanged disc 27 (Fig. 8) is mounted on a sleeve 28 and may be secured thereto by a pin 29. The sleeve 28 is threaded on the end of the spindle 24 and is held in position thereon by a binding screw 30. A face plate 31 and a ring 32 are rotatably mounted on the sleeve 28 and are held thereon by a flange at the outer end of the sleeve. The plate 31 may be clamped to the disc 27 by bolts 33.

The plate 31 is provided with teeth 34 around its periphery which are engaged by a pinion 35 mounted upon a stud 36 rotatable in bearings in a casing 37 supported by the spindle head 11. A driver 38 is fixed in the ring 32 and a bushing 39 is also fixed therein. The bushing 39 is threaded on its outer surface to receive a cap 40 rotatably secured to the end of a pin 41. The face plate 31 is provided with two hardened bushings 42 spaced apart by 180° and closely fitting the pin 41. The pin 41 may be withdrawn from one of the bushings by turning the nut 40 and may be thereafter inserted in the opposite bushing, thus advancing the work exactly 180° and adapting the grinder for grinding double threads. By providing additional bushings 42, the grinder may be adapted for use with triple threads.

When a piece of work is mounted on the work centers of the grinder and is secured to the driver 38, the work must usually be adjusted angularly so that the grinding wheel will accurately enter the thread. By loosening the bolts 33 and turning the stud 36 upon which the pinion 35 is mounted, the face plate 31 will be rotated relatively to the disc 27 and spindle 24, affording a convenient and rapid adjustment of the work relative to the wheel.

The wheel head 13 (Fig. 4) is mounted to slide toward and from the work on a wheel carriage 43 and is held from upward movement by suitable guide plates 44 and 45. The wheel carriage is also movable transversely on a wheel table 46 and is guided thereon by a dove tailed projection 47 shown in dotted lines in Fig. 4. A gib 48 may be clamped against the guide 47 by binding screws 49 (Fig. 2) to hold the carriage 43 in adjusted position on the table 46. A rack 50 (Fig. 4) is secured to the under side of the carriage 43 and is engaged by a pinion 51 on a shaft 52 extending longitudinally of the table 46 and having a wheel 53 (Fig. 2) fixed at the outer end thereof. The wheel 53 may be turned manually for rapid adjustment of the grinding wheel toward and from the work, radial openings being formed in the periphery to receive the end of a rod for such adjustment.

The table 46 is movable longitudinally upon supporting surfaces 54 and 55 (Fig. 2) on the base 10. A lead screw 56 (Fig. 1) is rotatable in bearings 57 on the base 10 and engages a nut on the under side of the wheel table 46 by which the table is moved longitudinally of the work. The lead screw 56 is connected through a gear train 58 to the spindle 24 and may thus be rotated in any desired definite relation to the revolutions of the spindle.

The carriage 43 is provided with a slotted rearward extension 59 (Figs. 1 and 2) adapted to be secured to a block 60 by a binding screw 61. The block 60 is slidable on a taper bar 62 supported on brackets 63 extending rearward from the base 10. The taper bar may be adjusted at any desired angle by adjusting screws 64 and may be held in adjusted position by clamping screws 65, the angle at which the bar is set being indicated on a fixed scale 66 (Fig. 2).

When it is desired to grind a taper thread, the binding screws 49 are loosened to permit free transverse movement of the carriage 43 and the clamping screw 61 is tightened to connect the carriage with the sliding block 60. As the wheel table 46 is thereafter moved longitudinally the wheel carriage 43 will be moved toward or from the work in accordance with the position of the taper bar 62.

The carriage 43 has an upward projection 67 (Fig. 5) in which a stop or anvil 68 is secured. A stop rod 69 is threaded in a nut 70 which is fixed in the wheel head 13. The head 13 and stop rod 69 are moved forward to engage the anvil 68 by a cylindrical weight 71 (Figs. 1 and 2) supported on arms 72 pivoted at 73 to the wheel carriage 43 and each engaging a roll 74 on the forward end of a bell crank lever 75 pivoted at 76 to the carriage 43. The upwardly extending arms of the bell cranks engage projections 77 on the rear of the wheel head 13 and force the head yieldingly forward until the stop rod 69 (Fig. 5) engages the anvil 68.

Provision is made for accurate transverse adjustment of the grinding wheel by rotating the threaded stop rod 69 in the nut 70. For this purpose a bevel pinion sleeve 78 is mounted in a bearing in the head 13 concentric with the stop rod 69. The rod 69 is slidable in the sleeve 78 but is keyed thereto to prevent relative angular movement. A bevel gear 79 is mounted on a shaft 80 in position to drive the pinion 78. The shaft 80 is supported in bearings in the head 13 and is provided with a worm gear 81 at its upper end, driven by a worm 82 on a shaft 83 also rotatable in bearings in the head 13 and provided with a hand wheel 84 at its upper forward end. This hand wheel constitutes means by which the stop rod 69 may be rotated and adjusted longitudinally in the nut 70 fixed in the head 13.

A graduated disc 85 is loosely mounted on a flanged collar 86 on the shaft 83 but may

be secured thereto by plungers 87 slidable radially in the collar and forced outwardly to clamping position by a screw 88 having a tapered inner end. The disc 85 is graduated as indicated in Fig. 4 and a fixed index mark is provided in the enlarged outer end 89 of the bearing for the shaft 83.

By loosening the binding screw 88 the disc 85 may be set in any desired relation to the index mark on the bearing 89 and may be thereafter clamped to the shaft 83 by tightening the screw 88.

A stop collar 90 (Fig. 5) and a locking collar 91 are provided at the rear end of the stop rod 69 to limit rearward adjustment of the head 13 when desired.

It is usually necessary to withdraw the grinding wheel from the work when a cut is completed and to hold it withdrawn while the carriage is returning to position for starting another cut. We have provided means for thus withdrawing the wheel quickly without disturbing the adjustment of the stop rod 69.

For this purpose a hand lever 92 (Fig. 2) is pivoted at 93 to the wheel head 13 and is connected by a link 94 to a lever 95 pivoted at 96 to the wheel carriage 43 and also having a bolt and slot connection 97 with the wheel head 13. Backward pressure upon the hand lever 92 thus acts to force the wheel head 13 rearward against the pressure of the weight 71, which is moved upward by such rearward movement of the head.

As the head reaches its extreme rearward position, a spring plunger 98 (Fig. 4) snaps into a recess in the table 43 and holds the head in withdrawn position. A release device 99 is provided for withdrawing the plunger 98 when the wheel head is to be returned to working position.

By the mechanism thus far described, we have provided for moving the wheel longitudinally in definite relation to the revolutions of the work, and we have provided for rapid approximate adjustment of the wheel toward the work and for accurate final adjustment thereof. We have also provided means for temporarily withdrawing the wheel from the work without disturbing the wheel adjustment and for holding the wheel thus withdrawn until released, and we have provided means for moving the wheel at an angle to the axis of the work when grinding taper threads.

The grinding wheel W is mounted on a shaft rotatable in a bearing plate 100 (Fig. 2). It is necessary to adjust the wheel shaft to different vertical angles in accordance with the pitch of the thread being ground and for this purpose the bearing plate 100 is adjustably secured to a vertical supporting plate 101 on the wheel head 13. The rear face of the bearing plate 100 is grooved to receive a segmental guide 102 (Fig. 4) on the front of the supporting plate 101. An adjusting screw 103 (Fig. 2) is supported by a swivel bearing on the plate 101 and engages the bearing plate 100 for adjusting the same angularly, the angular position being indicated on a scale 104 (Fig. 4). When correctly adjusted the plate may be held in position by clamping screws 105.

The supporting plate 101 is mounted for limited longitudinal adjustment on dovetailed guides 101^a (Fig. 2) on the wheel head 13 and is movable along said guides by an adjusting screw 101^b (Figs. 2 and 4). Such longitudinal adjustment may be used in matching the wheel to the thread on the work and is alternative to the use of the adjustable face plate mechanism shown in Fig. 8.

A suitable pump connection (not shown) supplies water or grinding compound to the wheel W. A pan 106 is suitably supported on the side of the wheel head 13 to carry the water to the front of the table 46 where it enters a suitable passage in the base 10. We have found that it is of considerable advantage to mount the pan 106 for movement with the head 13 instead of placing it in fixed position on the table 46.

Having thus described our invention, the advantages and uses thereof will be readily apparent. The necessary adjustments and manipulations of the parts may be readily performed from the front of the machine, and the machine may be quickly and easily set for grinding any desired pitch or size of thread.

Having thus described our invention it will be evident that changes and modifications can be made therein by those skilled in the art within the spirit and scope of our invention as set forth in the claims, and we do not wish to be otherwise limited to the details herein disclosed but what we claim is:—

1. In a thread grinder, a wheel head, a carriage on which said head is movable transversely, a stop member on said carriage, a co-operating stop member on said head, means to adjust one of said stop members, and means to yieldingly advance said head, effecting engagement of said members.

2. In a thread grinder, a wheel head, a carriage on which said head is movable transversely, a stop on said carriage, a stop rod adjustable in said head, and means to yieldingly advance said head to engage said rod with said stop.

3. In a thread grinder, a wheel head, a carriage on which said head is movable transversely, a stop on said carriage, a co-operating stop member on said head, and means to adjust said member relative to said head, said head having an index fixed there-

on, and said means including an adjustable graduated disc by which relative forward movement of the head is indicated.

4. In a thread grinder, a wheel head, a carriage on which said head is movable transversely, a stop on said carriage, a co-operating stop member on said head, and means to adjust said member relative to said head, said head having an index fixed thereon, and said means including a worm shaft, a graduated disc rotatably mounted on said shaft, and means to clamp said disc in adjusted angular position on said shaft.

5. In a thread grinder, a grinding wheel, a pair of co-operating stop members to limit the movement of said wheel toward the work, a hand wheel, a positive geared connection from said hand wheel to one of said stop members, a fixed index, a movable indicating device mounted concentric with said hand wheel, and means to clamp said device to rotate in adjusted angular relation to said hand wheel.

6. In a thread grinder, a grinding wheel, a pair of co-operating stop members to limit the movement of said grinding wheel toward the work, a hand wheel, a positive geared connection from said hand wheel to one of said stop members, a fixed index, a movable indicating device mounted concentric with said hand wheel, and means to clamp said device to rotate in adjusted angular relation to said hand wheel, said means comprising radially movable plungers engaging an inner surface of said disc and means to force said plungers outward against said disc.

7. In a thread grinder, a grinding wheel, a wheel shaft, a wheel head on which said shaft is supported for angular adjustment, means to move said head yieldingly toward the work, an adjustable stop to limit such movement, and manual means to move said head quickly from the work.

8. In a thread grinder, a grinding wheel, a wheel shaft, a wheel head on which said shaft is supported for angular adjustment, means to move said head yieldingly toward the work, an adjustable stop to limit such movement, manual means to move said head quickly from the work, and means to hold said head in withdrawn position.

9. In a thread grinder, a grinding wheel, a wheel shaft, bearings for said shaft, a plate on which said bearings are mounted, a wheel head, means to adjust said plate in a segmental arc on said head about a substantially horizontal axis outside of said plate and perpendicular to the axes of the wheel shaft and work, and means to secure said plate in adjusted position.

10. In a thread grinder, a grinding wheel, a wheel shaft, bearings for said shaft, a plate on which said bearings are mounted, a wheel head, said plate and head having a co-operating segmental rib and curved recess by which said plate may be guided for angular adjustment about a substantially horizontal axis outside of said plate and perpendicular to the axes of the wheel shaft and work, and means to secure said plate in adjusted position on said head.

11. In a thread grinder, a grinding wheel, a wheel head, a support on which said head is mounted for movement toward and from the work, and a cover plate for said support mounted on and movable with said wheel head.

12. In a thread grinder, a grinding wheel, a wheel head, a carriage on which said head is movable transversely, a table on which said carriage is movable transversely, means to feed said table longitudinally of the work, manual means to move said carriage transversely on said table, and additional means to give said carriage a transverse movement having definite relation to the longitudinal movement of the table.

13. A thread grinder having in combination, a base, a work-supporting head, a work table to which said head is secured, a longitudinally movable wheel table, and a positive gear drive from said head to said wheel table, said work table being pivoted to the base at the head end of said table, and means being provided effective to slightly adjust said work table angularly about its pivot on said base and to secure said work table to said base in adjusted angular position while maintaining the positive gear connection between the parts.

14. In a thread grinder, a grinding wheel, a wheel shaft, bearings for said shaft, a bearing plate 100, a supporting plate 101, a wheel head 13, means to adjust said bearing plate angularly on said supporting plate, and means to adjust said supporting plate lengthwise of the machine on said wheel head.

In testimony whereof we have hereunto affixed our signatures.

JOHN BATH.
ROBERT H. C. GRUNEWALD.