W. F. GROENE AND W. G. HOELSCHER.

LATHE.

APPLICATION FILED OCT. 3, 1917.

1,314,744.

Patented Sept. 2, 1919.

4 SHEETS—SHEET 1.

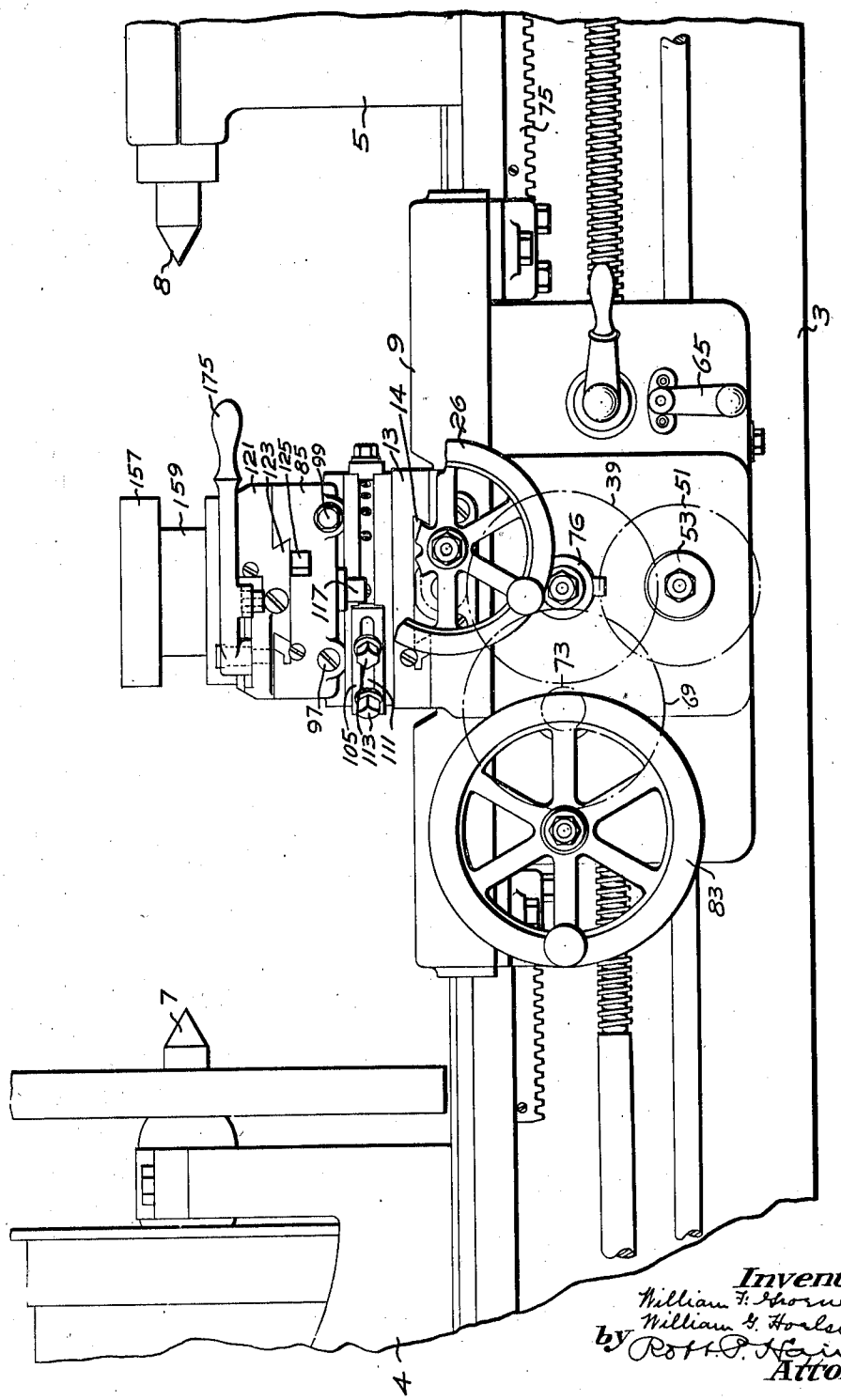


Fig. 1

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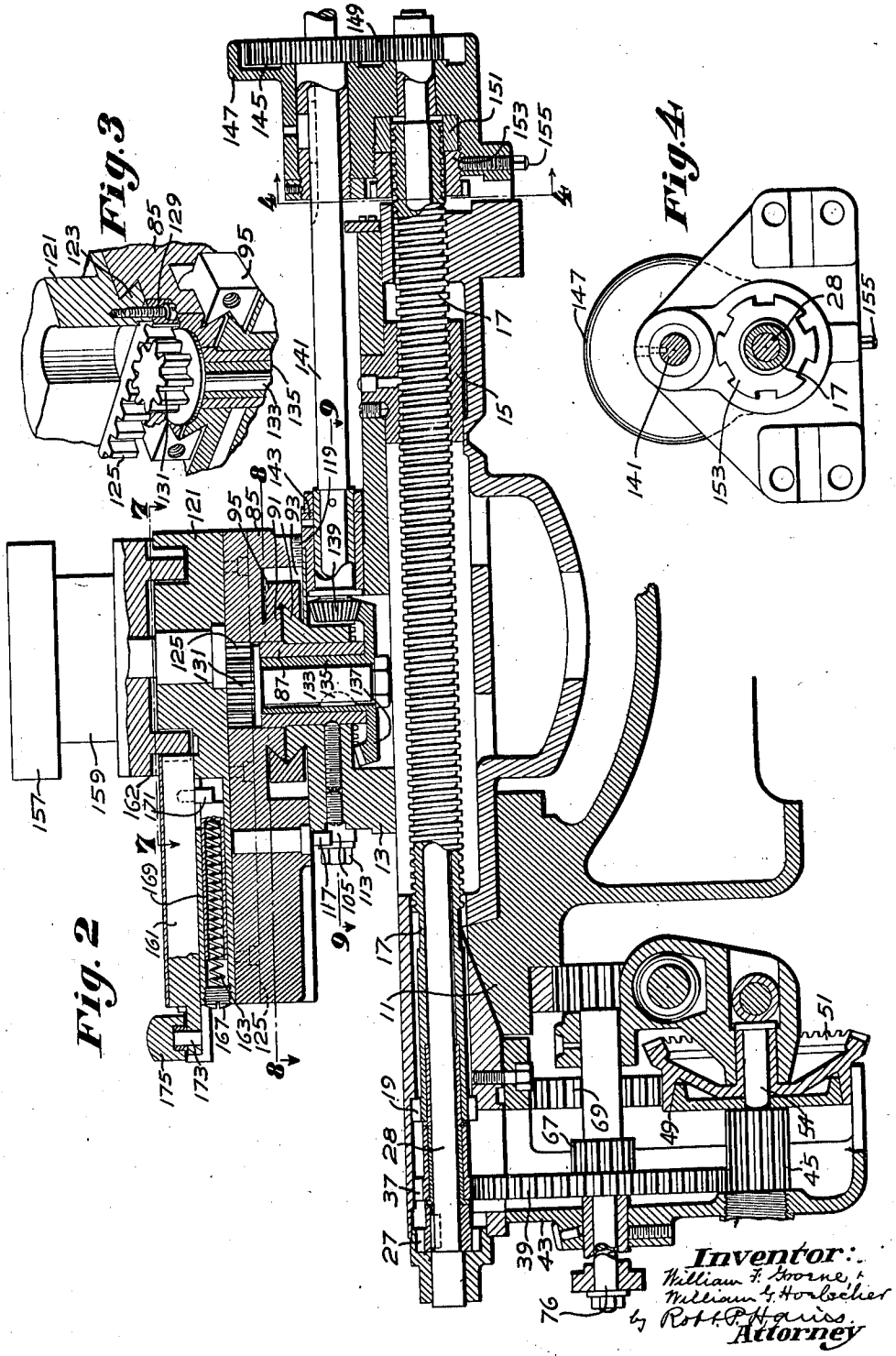
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4 SHEETS—SHEET 3.

Fig. 5

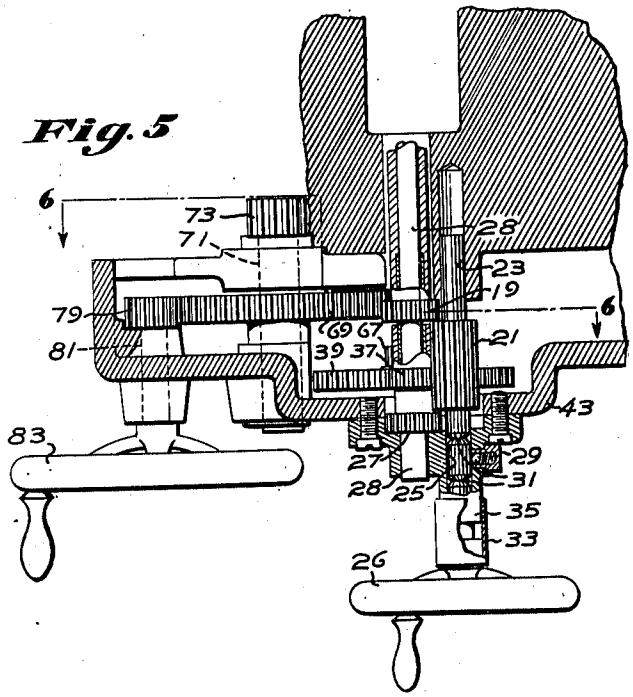
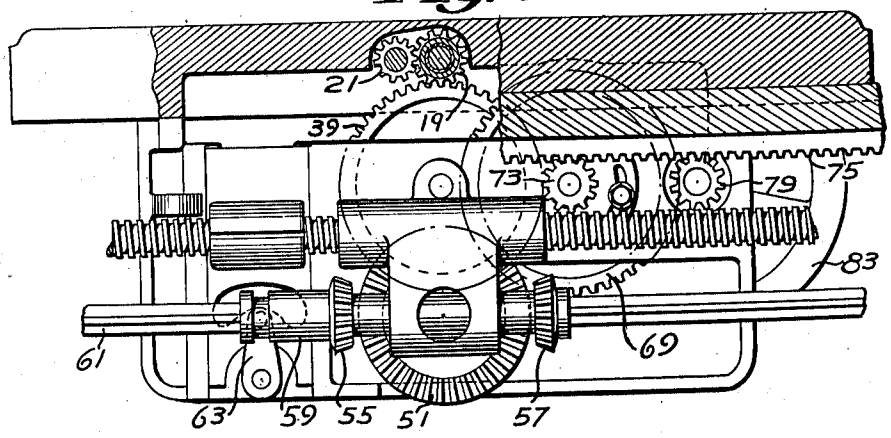


Fig. 6



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4 SHEETS—SHEET 4.

Fig. 7

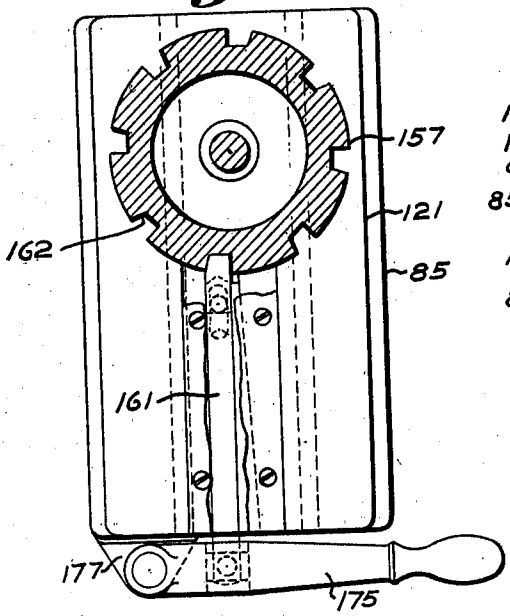


Fig. 8

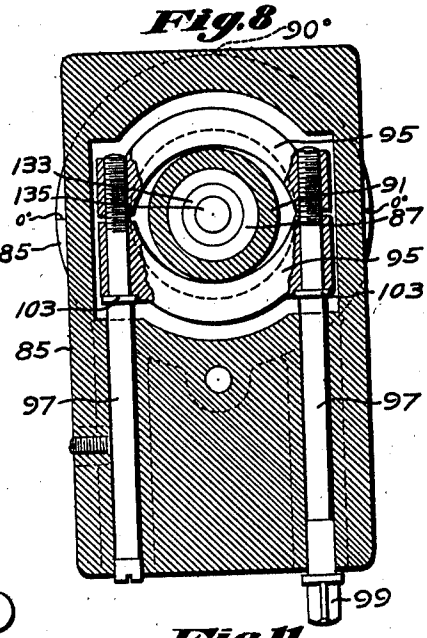
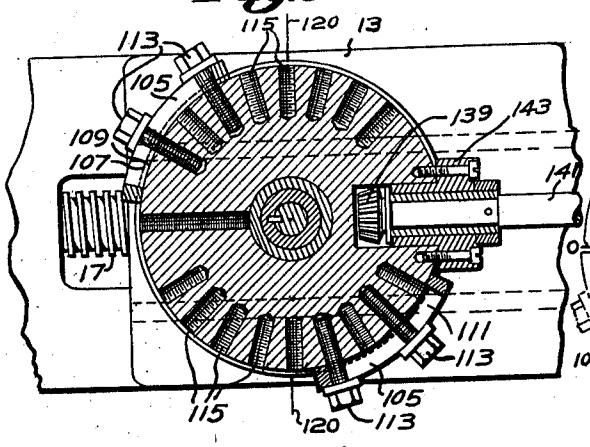


Fig. 11



Fig. 9



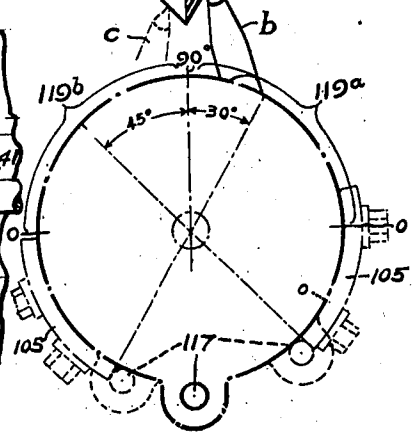
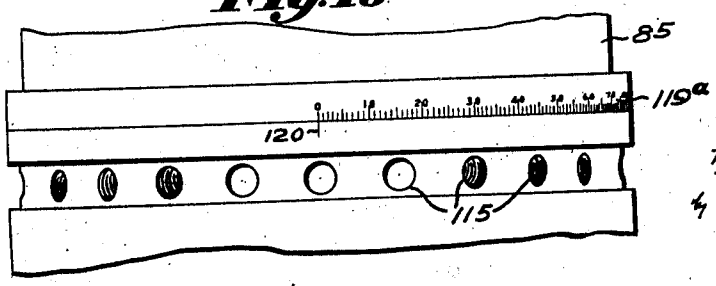


Fig. 10



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UNITED STATES PATENT OFFICE.

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1,314,744. Specification of Letters Patent. Patented Sept. 2, 1919.

Application filed October 3, 1917. Serial No. 194,478.

To all whom it may concern:

Be it known that we, WILLIAM F. GROENE and WILLIAM G. HOELSCHER, citizens of the United States, residing at Cincinnati, county of Hamilton, and State of Ohio, have invented an Improvement in Lathes, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

The invention hereinafter described relates to machine tools and more particularly to lathes.

The usual lathe comprises a bed with live and dead spindles thereon to support and rotate the work, and a carriage supporting a cross slide with a rest thereon for the tool acting on the work. The carriage may be fed to carry the tool longitudinally of the bed and the cross slide may be fed to carry the tool transversely of the bed.

In certain classes of work it is also desirable to swivel the tool rest on the cross slide and feed the tool relatively to the work in different positions of angular adjustment. Mechanisms have been devised for this purpose, but they are objectionable for various reasons. Among others, they are too large and cumbersome to apply to the smaller types of lathes where the distance between the top of the carriage and the center line of the spindle is limited.

One of the objects of the present invention is to provide a strong, simple and compact mechanism for feeding the tool relatively to the work in different positions of angular adjustment, suitable for small as well as large lathes.

In the practical embodiment of this feature of the invention, the shaft for driving the angular feed passes through the cross feed screw to the rear thereof and permits its movement through a train of mechanism to a pinion and rack for moving the top slide in the angular direction predetermined by adjustment of the angularly movable or swivel element.

Another object and important feature of the present invention consists in simple and effective means for quickly and accurately setting the tool rest to different positions of angular adjustment. This feature of the invention, in the form herein described, is carried into effect by one or more adjustable elements or dogs having means for securing it or them in position for coöperative relation with a stop, the dogs and stop being associated, one with the slide and the other with the angularly adjustable tool carrying element or swivel member so that by adjustment of the dog or dogs the angular position of the swivel element is readily determined.

And still another object is to provide means for quickly locking the tool rest in its positions of adjustment. In carrying this feature of the invention into effect, the present invention, in the form herein described, contemplates a clamping device comprising in its construction a split ring drawn together by suitable drawing means, such as a bolt or other rapid acting means.

Other objects and features of the invention, in addition to those hereinbefore generally referred to, will be hereinafter more fully described in connection with the form or embodiment of the invention illustrated by the accompanying drawings and then the novel features and combinations comprised within the invention will be definitely set forth by the claims.

Figure 1 is a front elevation of a portion of the lathe equipped with a mechanism embodying the invention;

Fig. 2 is a vertical transverse section through the mechanism;

Fig. 3 is a perspective view of the pinion and rack device for feeding the upper slide at various angles, parts being broken away and others in section;

Fig. 4 is a vertical section taken on line 4—4 of Fig. 2;

Fig. 5 is a horizontal section showing the train of mechanism in the apron for transmitting the drive to the cross slide and upper slide;

Fig. 6 is a vertical section through the

gear mechanism in the apron taken on line 6—6 of Fig. 5;

Fig. 7 is a section taken on line 7—7 of Fig. 2 showing the upper slide and the locking device for the tool rest;

Fig. 8 is a horizontal section taken on line 8—8 of Fig 2;

Fig. 9 is a horizontal section taken on line 9—9 of Fig. 2;

Fig. 10 is an elevation of adjacent curved portions of the swivel member and cross slide showing the scale on the former and the index line on the latter adapted to be read in connection with said scale; and

Fig. 11 is a diagram illustrating the adjustments of the swivel member for turning faces on a gear blank.

Referring to the drawings, the machine shown therein as embodying the invention comprises the usual standard supporting a bed 3 having a live spindle head 4 and a dead spindle head 5 mounted thereon and carrying spindles 7 and 8 respectively for supporting and rotating the work in the usual manner.

A carriage 9 is mounted on and adapted to be fed along tracks 11 on the bed longitudinally of the latter.

A cross slide 13 is mounted on the carriage and is adapted to be fed along the same transversely of the bed. It is guided in this instance of the invention by a dovetail 14 on the carriage entering a groove in the bottom of the slide.

To feed the cross slide transversely of the bed, it may have a nut 15 (Fig. 2) secured thereto and depending therefrom threaded to receive a hollow screw shaft 17 extending transversely of said carriage and journaled in bearings therein, the construction being such that upon rotation of the screw shaft 17 the cross slide 13 will be appropriately moved.

A gear 19 fast on the feed screw shaft adjacent the forward end thereof is adapted to be driven by a wide faced shiftable gear 21 fast on a shaft rotatable and slidable in bearings 23 and 25 in the carriage. The front end of this shaft may have a hand wheel 26 (Fig. 5) fast thereon permitting rotation of the wide faced gear and the screw shaft to feed the cross slide manually if desired.

The wide faced gear may be adjusted to three different positions. When thrust to its extreme inward position, it will be in mesh with the screw shaft gear and serve to transmit rotation thereto. When pulled to its extreme outward position, it will mesh with a gear 27 on a shaft 28 projecting through the screw shaft for a purpose to be described. When in its intermediate position it will be out of engagement with both of said gears. The wide faced gear shaft may be held in its two extreme positions of adjustment by a spring-pressed ball 29 adapted to enter circumferential grooves 31 in said shaft.

Thus, the hand wheel serves the dual function of shifting the wide faced gear axially to its different positions of adjustment and of rotating said shaft to manually feed the cross slide. The hub of the hand wheel may have a sleeve 33 fast thereon which will slide along a boss 35 projecting forwardly from the carriage to prevent the chips or cuttings from the tool from reaching and injuring the shaft or its bearing.

The wide faced gear continually meshes with a gear 37 loose on the shaft 28, referred to, adapted to be driven by a gear 39 (Figs. 2, 5 and 6) fast on a stud shaft journaled and adapted to slide in bearings in the carriage apron 43. The gear 39 is driven by a wide faced pinion 45, adapted to be connected by a friction clutch 49 with a large bevel gear 51, said clutch being controlled by a handle 53 (Fig. 1) on a stem 54 passing through the pinion 45 and connected to the hub of the bevel gear 51. The latter may be rotated in opposite directions by bevel pinions 55 and 57 (Fig. 6) fast on a sleeve 59 splined to a driving shaft 61. The sleeve may be shifted axially of said shaft to bring said bevel pinions alternatively into mesh with said bevel gear by a yoke 63 controlled by a handle 65 (Fig. 1) at the front of the apron.

The construction is such that the cross slide may be fed in opposite directions from the shaft 61 by a driving train in the apron quite similar to that shown in Letters Patent, No. 980,971, of R. K. Le Blond and W. F. Groene, granted January 10, 1911.

To feed the carriage longitudinally of the bed, the shaft for the gear 39, referred to, may have a pinion 67 (Fig. 2) fast thereon adapted to mesh with a gear 69 on a shaft 71 (Fig. 5) journaled in bearings in the apron and carrying a rack pinion 73 (Fig. 6) meshing with a rack 75 mounted on the bed. The gear 39 and pinion 67 may be shifted axially by a handle 76 (Figs. 1 and 2). When this handle is thrust inward, the gear 39 will be thrown out of mesh with the gear 37, thereby interrupting the transmission to the cross slide, and the pinion 67 will be thrown into mesh with the rack gear 69, thereby completing the transmission to the pinion 73 and causing the carriage to feed longitudinally of the bed.

To feed the carriage manually along the bed, the gear 69 (Fig. 5) may mesh with a pinion 79 fast on a shaft 81 journaled in a bearing in the apron and carrying a hand wheel 83 at the front of the apron.

A swivel member 85 (Figs. 1 and 2) is mounted on a portion of the slide and said parts have vertical registering bores receiv-

ing a bushing 87 about which said swivel member is adapted to turn.

To secure the swivel member in different positions of angular adjustment on said cross slide, said member and slide may have opposed conical projections 91 occupying a recess 93 in the base of said swivel member. Clamping means, in the present instance of the invention, comprises a split ring having sections 95 (Fig. 8) adapted to embrace said conical projections.

Horizontal screws 97 may be threaded into one section and pass loosely through the other section, and thence outwardly through bearings in the swivel member. One of said screws presents a squared end 99 adapted to receive a handle or wrench for adjusting the same. The other screw has a head adapted to receive a screw driver to set the same in proper position of adjustment when the parts are assembled. The screws have washers 103 confined between shoulders on said screws and one of the ring sections. The construction is such that one of the screws may be adjusted to a fixed position and the other may be tightened to contract the split ring and cause the same to grip the conical projections of the slide and swivel member and securely hold the latter in its positions of rotative adjustment on the former.

Next will be described means to facilitate prompt and accurate angular adjustment of the swivel member with respect to the cross slide. This means, in the present instance of the invention, comprises one or more dogs 105 (Figs. 1 and 9) having curved tongues 107 fitting a circumferential groove 109 in the cross slide. Each dog may have an elongated slot 111 therein receiving a pair of screws 113 adapted to be secured in a series of tapped holes 115 (Fig. 9) in said groove. The elongated slots may be longer than the distances between the holes, and hence it is evident that said dogs may be set at any required position of circumferential adjustment in said groove. A stop 117 (Figs. 1 and 2) may be secured to the under side of the swivel member in the path of said dogs and coöperate therewith to determine the angular adjustment of the swivel member according to the location of the dogs.

To enable the dogs to be quickly and accurately set in their positions of adjustment, scales 119^a and 119^b (Figs. 10 and 11) may be provided comprising series of graduations on a circular portion of the swivel member, each series being marked from 0° to 90°, and adapted to be read in connection with diametrically opposed index lines 120 (Figs. 9 and 10) on the curved portion of the cross slide directly beneath the swivel member.

In setting the parts in position to turn faces at different angles with respect to a piece of work, the swivel member is rotated until the graduation on one of the scales corresponding to the angle desired, registers with one of the index lines on the cross slide. Then one of the dogs is adjusted in the circumferential groove in the cross slide to bring one of its ends in engagement with the stop 117 on the swivel member. If it is desired to adjust the swivel member again to this same angle, the dog will be in position to determine the adjustment without necessity for reference to the scale, it being merely necessary to rotate the swivel member until its stop again engages the dog.

To set the swivel member in position to turn another face having a different angle on the work, the swivel member is rotated until the graduation on the other scale corresponding to the angle desired, registers with the other index line. In the course of this adjustment, the stop on the swivel member will assume a different position. Then the other stop dog is adjusted in the circumferential groove of the cross slide until one of the ends thereof engages said stop. The dog will then be in position to determine the adjustment of the swivel member the next time it is desired to turn a face on the work at the same angle without the necessity for reference to the scale.

For example, it may be supposed that it is desired to turn on a gear blank *a* (Fig. 11) a face at an angle of 30° to the plane of the gear in readiness to have teeth milled therein, and that it is desired to then turn a back face on the blank at an angle of 45° to the plane of the gear. If the turning tool *b* on the tool rest is perpendicular to the axis of the gear when the zero graduations of the scales register with the index line 120, then the swivel member will be rotated to the right (Fig. 11) until the graduation marked 30° on the scale 119^a registers with one of the index lines. The screw 97 is then tightened to cause the ring sections 95 to clamp the swivel member in this position of adjustment. The simultaneous rotation of the gear blank and the feeding of the upper slide and the tool will turn the face on the gear blank at an angle of 30° to the plane of said gear blank. To enable a quick return of the swivel to this same adjustment, one of the dogs 105 is adjusted in its groove to a position determined by its engagement with the stop 117 on the swivel member.

To set the swivel member in position to turn the back face of 45° on the gear blank, the screw 97 is adjusted to release the ring sections from the swivel member, thereby permitting the latter to be rotated until the graduation of the scale 119^b thereon marked 45° registers with the other index line. The screw 97 is then adjusted to tighten the ring sections to the swivel member to secure the

same in this position. Simultaneous rotation of the gear blank and feeding of the upper slide and another tool *c* will turn the face on the gear bank at an angle of 45° to the plane thereof. To enable the return of the swivel member to this same adjustment without reference to the scale, the other dog 105 is adjusted to a position determined by its engagement with the stop 117 on the swivel member.

Thus, faces at angles of 30° and 45° or any desired angle may be turned on successive gear blanks by adjusting the swivel member to a position determined by the engagement of its stop with one of the dogs, and then by adjusting said swivel member to a position determined by the engagement of its stop with the other dog. The construction is such, that the swivel member can be quickly and accurately adjusted without reference to the scale.

An upper slide 121 may be mounted on the swivel member and have guiding connection therewith, as by a dovetail 123 projecting downward therefrom into a groove on the top of the swivel member.

To feed the upper slide along said member, the slide may have a toothed element, in the present instance of the invention, in the form of a rack 125 (Figs. 1, 2 and 3) secured by screws 129 to the under face of the dovetail on the slide. This rack projects into a recess in the top of the swivel member and meshes with a pinion 131 in said recess mounted fast on the upper end of a vertical shaft 133 keyed to a sleeve 135 journaled in the swivel bushing 87, referred to. The lower end of said sleeve has a bevel gear 137 fast thereon driven by a bevel pinion 139 having a hub fast on one end of a shaft 141 and journaled in a bushing in a bearing 143 in the cross slide, and confined against axial movement in said bearing. This shaft projects rearward through and is splined to the hub of a gear 145 journaled in a bearing in a bracket 147 secured to the rear end of the carriage. The construction is such, that when the cross slide is fed transversely of the carriage, said shaft will slide through the hub of said gear, but will always be effective to transmit the feed to the upper slide in the various positions of the cross slide.

The gear 145 is driven by a gear 149, having a hub journaled in a bearing in said bracket and secured to the upper slide feed shaft 28, referred to, which projects through the hollow screw shaft 17 for feeding the cross slide.

When the wide faced gear 21 is shifted outwardly by the hand wheel 26, it will bring said gear into mesh with the gear 27 on the forward end of the upper slide feed shaft 28. As a result, when the hand wheel 26 is rotated, it will enable the upper slide to be fed manually through the train of gearing described. If the gear 39 in the apron is shifted outwardly into mesh with the gear 37, the wide faced gear will be driven from the gear train described in the apron, thereby permitting the upper slide to be fed by power.

By the construction described, either the cross slide or the upper slide may be fed according to whether the wide faced gear is shifted to mesh with the driving gear on the cross feed screw shaft or the driving gear on the upper slide feed shaft projecting through said screw shaft.

The direction of feed for both of said slides will be determined by adjustment of the bevel pinions 55 and 57, referred to, into or out of mesh with the bevel gear 51 and under the control of the handle 65 at the front of the apron.

To confine the feed screw shaft for the cross slide against axial movement, it may have a collar 151 (Fig. 2) fast on the rear end thereof confined between an end of a recess in the bracket 147 and a sleeve nut 153 threaded in said recess and secured by a set screw 155. This nut may be adjusted to take up wear on said collar and prevent lost motion of the screw shaft in the direction of its axis.

The upper slide may serve to support any suitable instrumentality, but, in the present instance of the invention, it serves to support a tool rest or turret 157 (Figs. 1 and 2) having ways such as 159 therein to accommodate tools.

The turret may be adjusted rotatably on the upper slide to present the tools successively in active positions. To secure the tool rest in its positions of adjustment, the usual locking plunger 161 (Figs. 2 and 7) may be mounted in said upper slide and have its inner end adapted to engage notches 162 in the turret corresponding to the number of tools carried thereby. This plunger is normally urged inward to its active locking position by a coil spring 163 in a bore in said upper slide and confined between a plug 167 tapped in one end of said bore, and a tubular plunger 169 reciprocable in said bore. This plunger may engage a lug 171 depending from the locking plunger. To unlock the latter, its outer end may be connected by a pin 173 with a handle 175 fulcrumed on an ear 177 projecting from the upper slide.

It will be noted that the rack and pinion for feeding the upper slide along the swivel member are mounted in the same horizontal plane, and that the swivel member may be adjusted about the axis of said pinion to any position of rotative adjustment without interference with the feeding of the slide

along the swivel member. The rack and pinion and the gear train for rotating the latter, constitute a strong, compact organization, enabling the upper slide to be mounted closely adjacent to the upper surface of the carriage. Thus the mechanism is well adapted not only to large lathes, but also to small lathes, which necessarily have a limited space between the upper surface of the carriage and the spindle centers, in which to accommodate the feeding mechanism for the upper slide.

The machine described provides a simple and effective mechanism enabling the carriage to be fed longitudinally of the bed; the cross slide to be fed transversely of the bed and the upper slide to be fed in any selected direction in a horizontal plane; and the carriage and both slides may be fed by power or manually as desired with a minimum number of adjustments.

It will be understood that the invention is not limited to the specific embodiment shown, but that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:—

1. The combination of a carriage, a cross-slide thereon, a hollow feed screw operatively connected to the cross slide, an upper slide on the cross-slide, a feed shaft for the upper slide extending through the hollow feed screw, a driven shaft carried by the cross slide, driving connections between the feed shaft and driven shaft, and a train of mechanism including a rack and pinion for transmitting power from the driven shaft to the upper slide.

2. The combination with a carriage, of a cross-slide thereon, a hollow feed screw journaled in the carriage for moving the cross-slide, a swiveled member on the cross-slide, an upper slide on the swiveled member, a feed shaft for the upper slide extending through the hollow feed screw shaft, a shaft journaled on the cross-slide and operatively connected with the upper slide, and driving connections between the feed shaft and shaft on the cross-slide.

3. In a machine tool, the combination of a carriage, a lower cross-slide mounted thereon, a hollow feed screw for the slide, a swiveled member mounted on the cross-slide for angular adjustment, an upper slide mounted on the swiveled member, clamping means between the swiveled member and lower cross slide for clamping them in angularly adjusted relation, a feed shaft extending through the feed screw, a train of gearing extending through the lower cross slide and swiveled member and connected to the feed shaft, and means for driving the feed shaft.

4. The combination with a carriage, of a cross slide thereon, a nut on said slide, a hollow feed screw for said nut, an upper slide mounted on said cross slide, and means to feed said upper slide relatively to said cross slide including a shaft in said hollow feed screw.

5. The combination with a carriage, of a cross slide thereon, a nut on said slide, a feed screw for said nut, an upper slide mounted on said cross slide, a feed shaft for said upper slide, means at the front of said carriage for driving said shafts, a driven shaft, gears at the rear of said carriage to transmit power from the feed shaft for said upper slide to said driven shaft, and gears to transmit power from said driven shaft to said upper slide.

6. The combination with a carriage, of a cross slide thereon, a nut on said slide, a hollow feed screw shaft for said nut, an upper slide on said cross slide, a feed shaft for said upper slide projecting through said hollow shaft, a driven shaft journaled on said cross slide, gears to transmit power from the feed shaft for the upper slide to said driven shaft, and gears to transmit power from said driven shaft to said upper slide.

7. The combination with a carriage, of a cross slide thereon, a nut on said slide, a feed screw for said nut journaled in said carriage, a member swiveled on said cross slide, an upper slide on said member, a feed shaft for said upper slide, and means to transmit power from the shaft for said upper slide to the latter including a shaft beneath said swiveled member journaled on and movable axially with said cross slide.

8. The combination with a carriage, of a cross slide thereon, a feed screw shaft for said slide, an upper slide swiveled on said cross slide, a feed shaft for said upper slide journaled in said carriage, and means to transmit power from said feed shaft to said upper slide including a driven shaft journaled on said cross slide, and gears to transmit power from said feed shaft to said driven shaft, the latter being movable axially of one of said gears.

9. The combination with a carriage, of a cross slide thereon, a feed screw shaft for said slide, an upper slide swiveled on said cross slide, and means to feed the latter relatively to said cross slide including a feed shaft journaled in said carriage, a bearing on said cross slide, a bearing on said carriage, a driven shaft journaled in said bearings, and gear means to transmit power from said feed shaft to said driven shaft.

10. The combination with a carriage, of a cross slide thereon, a feed screw shaft for said slide, an upper slide swiveled on said cross slide, a feed shaft for said upper slide, bearings on said carriage and cross slide, a

driven shaft in said bearings, gears to rotate said driven shaft from said feed shaft, a swivel shaft, gears to rotate the latter from said driven shaft, a rack gear on said swivel shaft, and a rack on said upper slide meshing with said rack gear.

11. The combination with a carriage, of a cross slide thereon, a nut on said slide, a hollow feed screw shaft for said nut journaled in said carriage, an upper slide swiveled on said cross slide, a feed shaft for said upper slide projecting through said hollow shaft, gears on said shafts, and a shiftable gear for driving either of said gears.

12. The combination with a carriage, of a cross slide thereon, a feed shaft for said slide, an upper slide swiveled on said cross slide, a feed shaft for said upper slide, gear means to transmit power from the feed shaft for said upper slide to the latter, driving gears on said shafts, and a shiftable gear adapted to mesh with either of said driving gears.

13. The combination with a carriage, of a cross slide thereon, a feed shaft for said slide, an upper slide swiveled on said cross slide, a feed shaft for said upper slide, gear means to transmit power from said last named feed shaft to said upper slide, driving gears on said shafts, a shiftable gear, and manually operable means for rotating the latter and shifting the same into and out of mesh with said driving gears.

14. The combination with a carriage, of a cross slide thereon, a feed shaft for said slide, an upper slide swiveled on said cross slide, a feed shaft for said upper slide, driving gears on said feed shafts, a shiftable gear adjustable to mesh with either of said driving gears, a gear loose on the feed shaft for said upper slide meshing with said shiftable gear, and means to drive said loose gear.

15. The combination with a carriage, of a cross slide thereon, a swivel member on said cross slide, means connecting said slide and swivel member including opposed conical elements, means embracing said elements, means to adjust said embracing means to tend to draw said elements toward one another, an upper slide on said swivel member, driving means on said carriage, and means extending through the swivel member to transmit power from said driving means to said upper slide to feed the latter on said swiveled member.

16. The combination with a support, of a slide thereon, swivel means connecting the same, said support having a circumferential groove with a series of tapped holes therein, a dog in said groove, a screw to enter said holes selectively, to secure said dog in different positions of adjustment on said support, and a stop on said swivel means cooperating with said dog to position said swivel means.

17. The combination with a support, of a slide thereon adjustable angularly relatively to said support, a dog for one adjustable to different fixed positions, a stop on the other for engagement with said dog, and a scale and index means for indicating the adjustment of said slide.

18. The combination with a support, of a slide thereon adjustable angularly relatively to said support, a dog on said support, means to secure said dog in different positions of adjustment circumferentially of said support, a stop on the slide to engage said dog, and means to indicate the angular adjustment of said slide.

19. The combination with a slide of a swivel member thereon, a dog on said slide, means to secure said dog to said slide in different positions of adjustment, and a stop on said swivel member for engagement with said dog to determine the angular adjustment of said swivel member.

20. The combination with a support having a series of spaced tapped holes therein, of a swivel member on said support, a dog having an elongated slot therein of greater length than the spaces between said holes, a screw in said dog adapted to enter any of said holes, and a stop on said swivel member to engage said dog and determine the angular adjustment of said swivel member.

21. The combination with a support having a circumferential groove therein, of a swivel member on said support, a dog having a tongue entering said groove, means to secure said dog in different positions in said groove, a stop on said swivel member to engage said dog and determine the angular adjustment of said swivel member, a slide on the latter, and means to feed said slide along said swivel member.

22. The combination with a support, of a slide thereon adjustable angularly relatively to said support, a plurality of dogs adjustably secured to said support, and a stop for said slide for engagement with said dogs to enable repeated angular adjustment of said slide to positions determined by said dogs.

23. The combination with a support, of a swivel member thereon, dogs adjustable circumferentially of said support to fixed positions, and a stop on said swivel member adapted to engage either of said dogs, said swivel member and support having scale and index means for indicating the angular adjustment of said swivel member.

24. The combination with a support, of a swivel member thereon, a slide on said member, said support and swivel member having graduated scale and index means for indicating the angular adjustment of said swivel

member, a stop on the latter, a dog on said support adjustable to engage said stop and determine repeated angular adjustment of said member to a selected position, and means to feed said slide in any of its positions of angular adjustment.

25. In a machine tool, the combination of a carriage, a cross-slide thereon, a feed screw extending from front to rear of the carriage for moving the cross slide, a swivel member mounted on the cross slide, an upper slide mounted on the swivel member, means for adjusting and clamping the swivel member in angular relation to the cross-slide, a feed shaft extending through the feed screw, a driven shaft mounted on the cross slide, gearing at the rear of the carriage for operatively connecting the feed shaft and driven shaft, and operating connections between the driven shaft and upper slide for moving the latter relative to the swivel member in its angularly adjusted position.

In testimony whereof we have signed our names to this specification.

WILLIAM F. GROENE.
WILLIAM G. HOELSCHER.