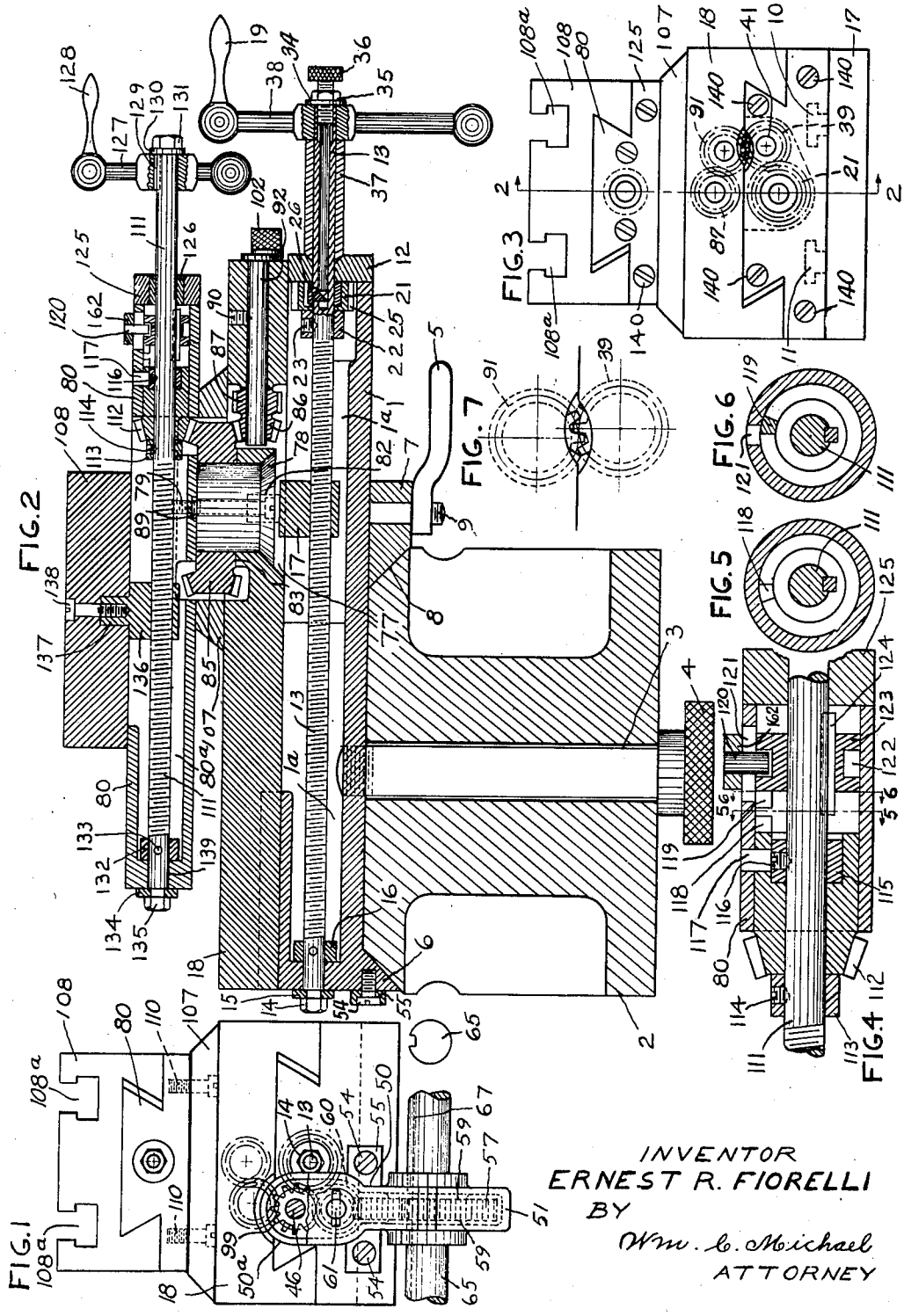
Nov. 16, 1943. E. R. FIORELLI 2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

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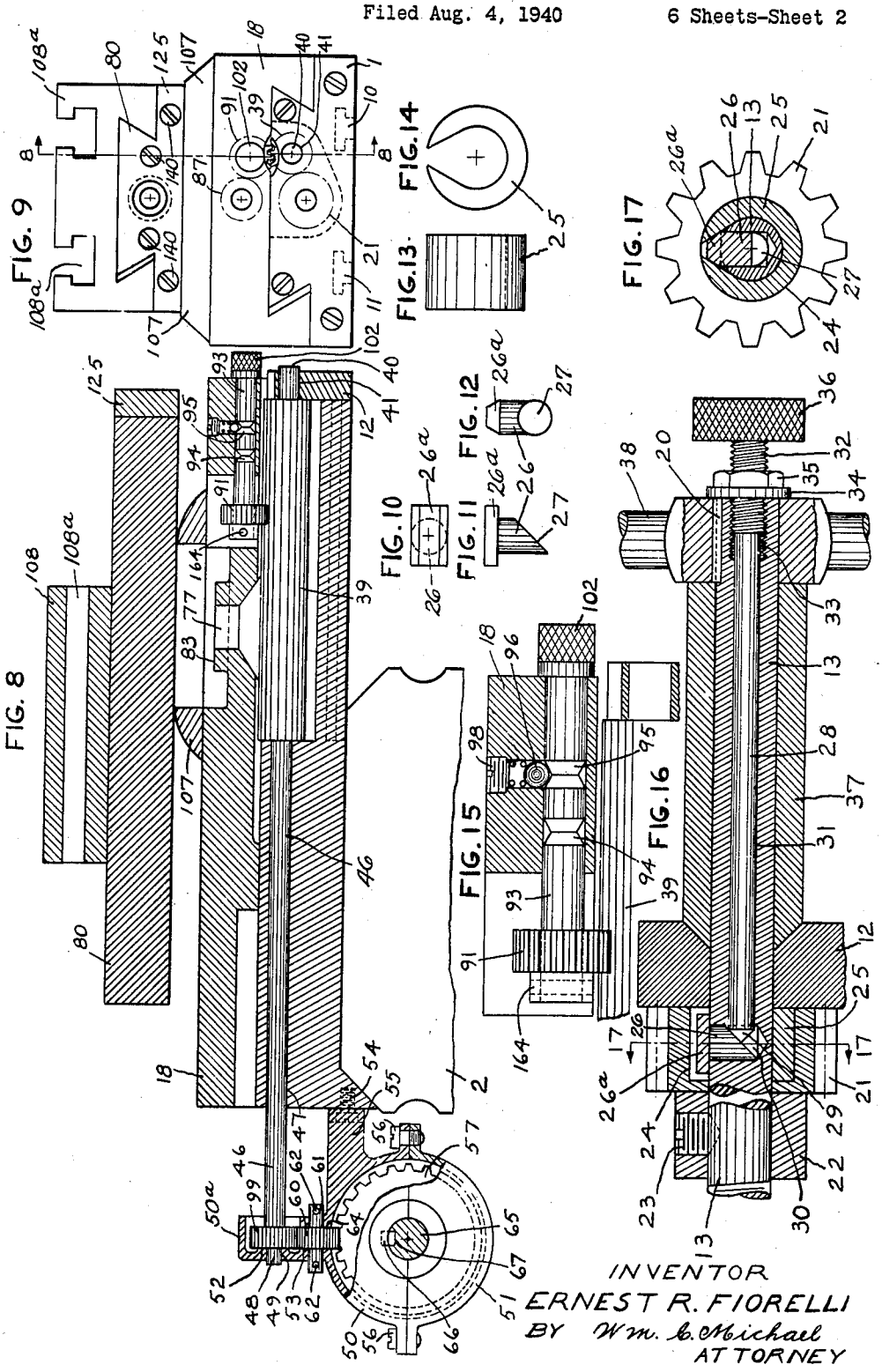


INVENTOR
ERNEST R. FIORELLI
BY
Wm. C. Michael
ATTORNEY

Nov. 16, 1943. E. R. FIORELLI 2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

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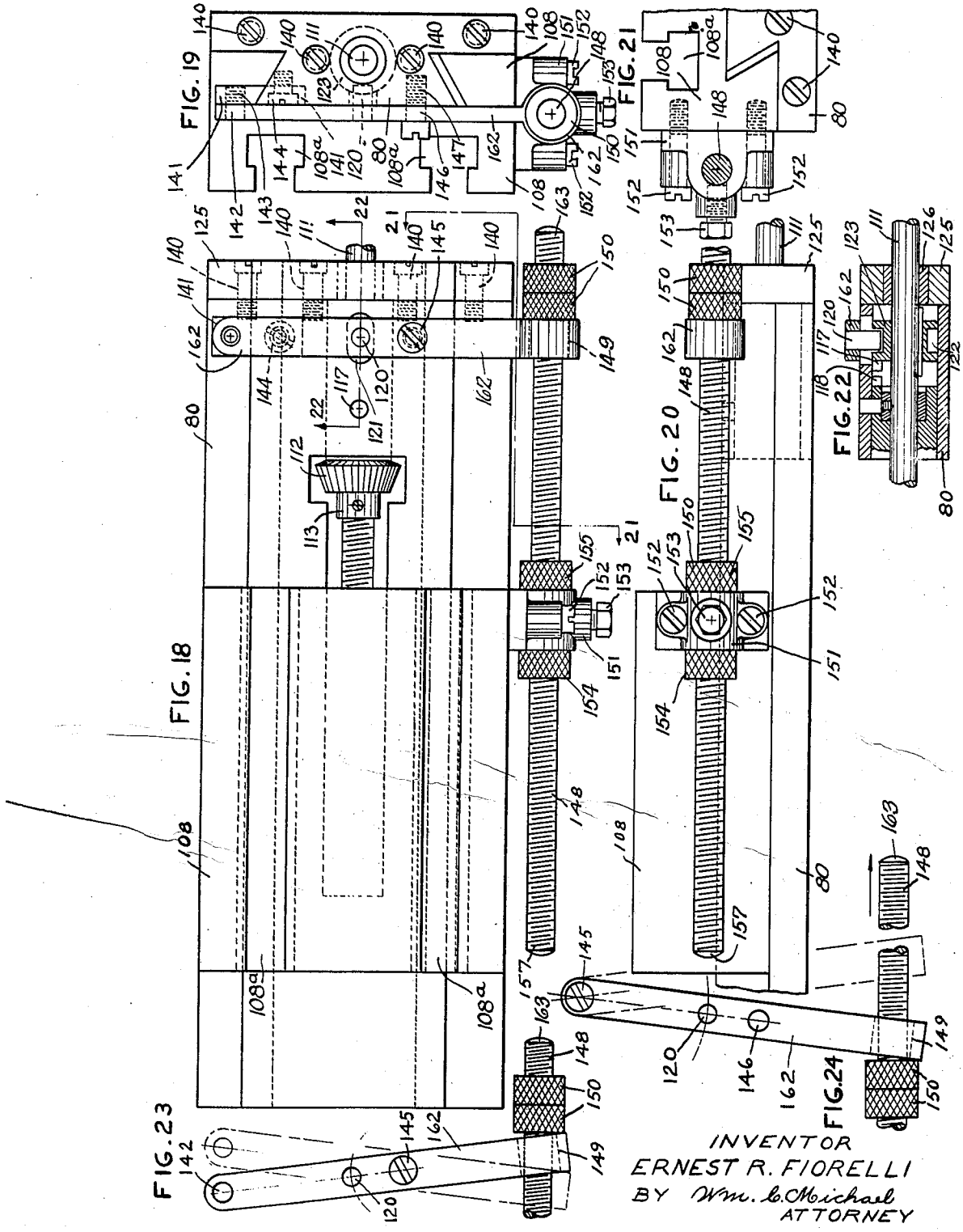


INVENTOR
ERNEST R. FIORELLI
BY Wm. S. Michael
ATTORNEY

Nov. 16, 1943. E. R. FIORELLI 2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

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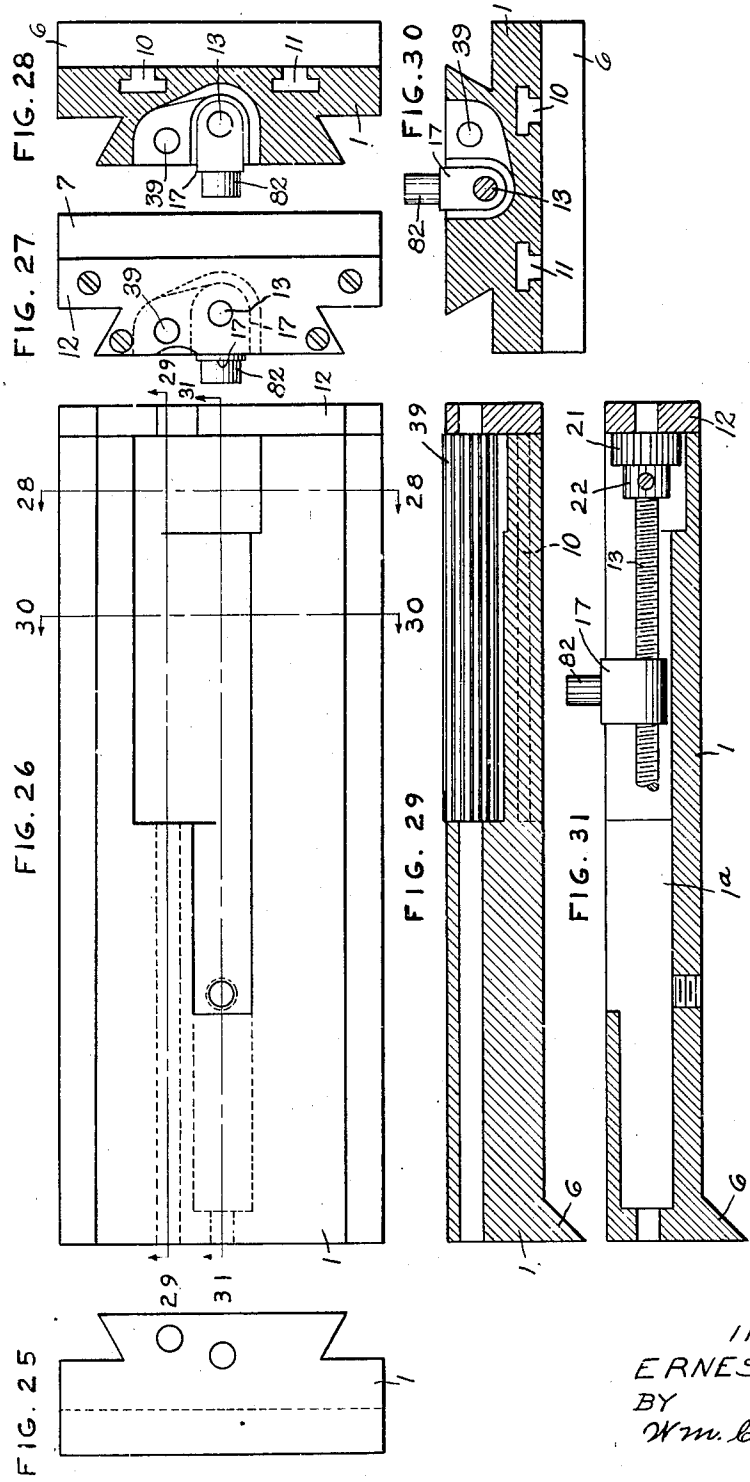


INVENTOR
ERNEST R. FIORELLI
BY Wm. C. Michael
ATTORNEY

Nov. 16, 1943. E. R. FIORELLI 2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

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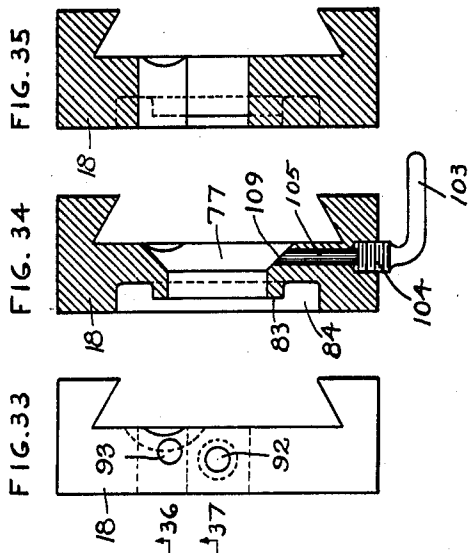


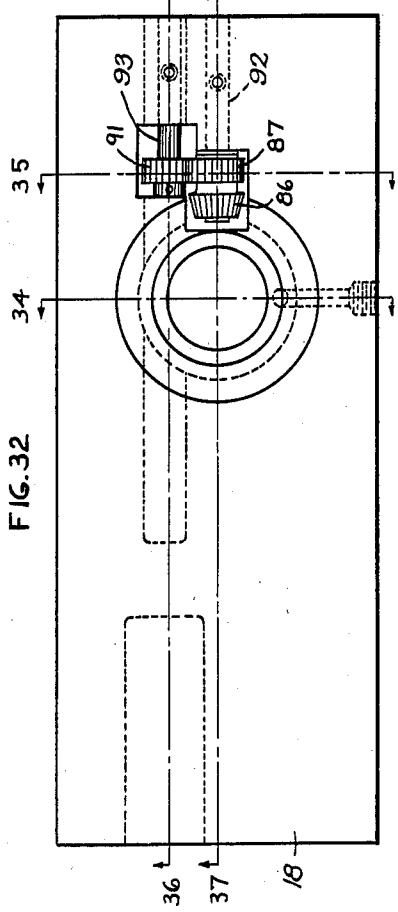
INVENTOR
ERNEST R. FIORELLI
BY
Wm. C. Michael
ATTORNEY

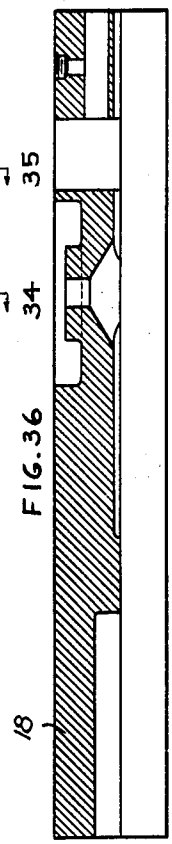
Nov. 16, 1943. E. R. FIORELLI 2,334,616

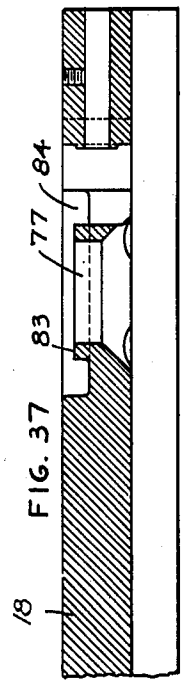
POWER FEED COMPOUND SLIDE REST FOR LATHES

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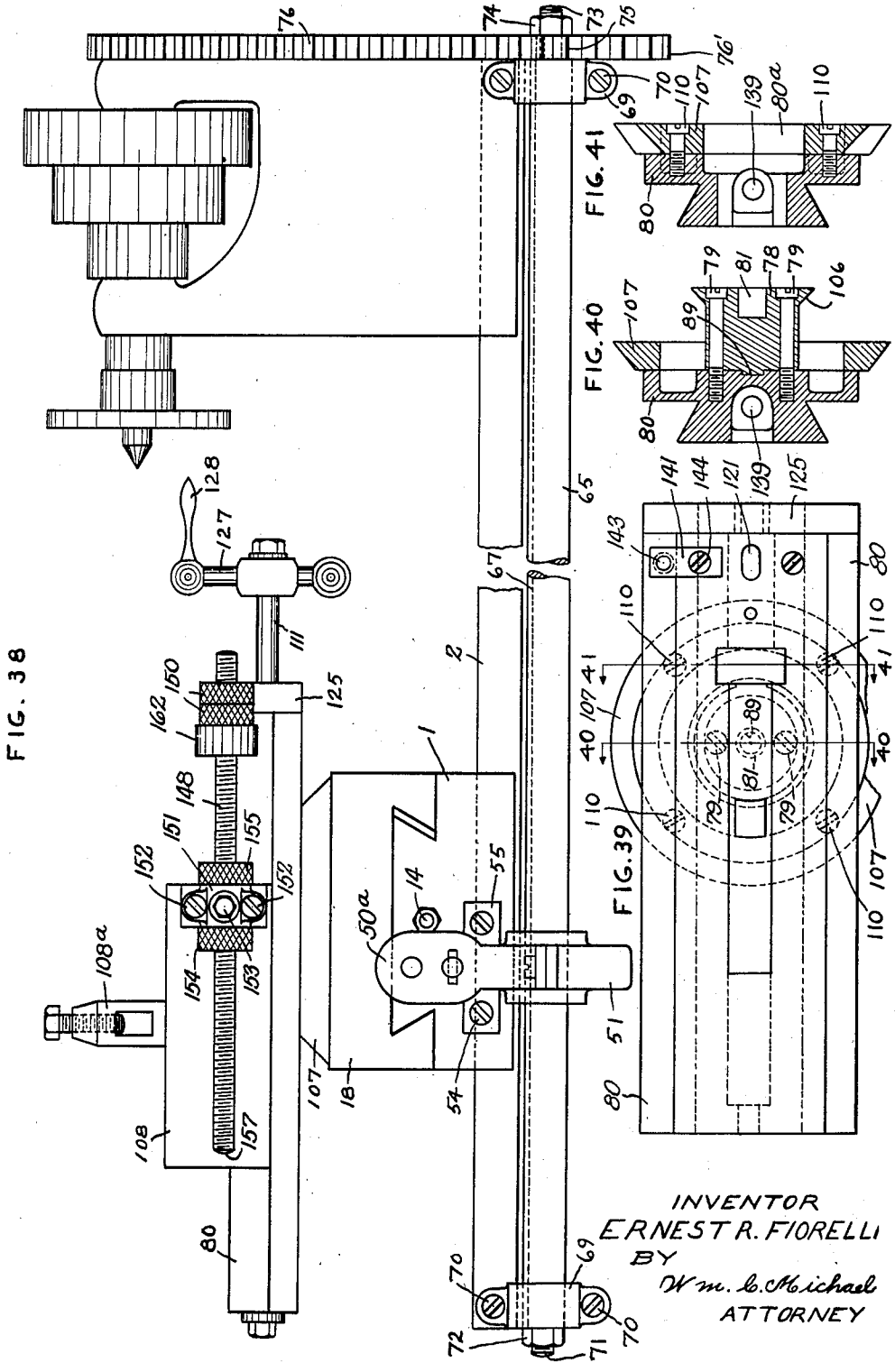


INVENTOR
ERNEST R. FIORELLI
BY
Wm. E. Michael
ATTORNEY

Nov. 16, 1943. E. R. FIORELLI 2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

Filed Aug. 4, 1940 6 Sheets-Sheet 6



Patented Nov. 16, 1943

2,334,616

UNITED STATES PATENT OFFICE

2,334,616

POWER FEED COMPOUND SLIDE REST FOR LATHES

Ernest R. Fiorelli, Waltham, Mass.

Application August 4, 1940, Serial No. 351,402

9 Claims. (Cl. 82—24)

My present invention relates to so-called bench and other lathes. More particularly it aims to provide such lathes with an improved compound slide rest for the tools, incorporating various automatic and power-drive features including selective manual and power control for both upper and lower carriage and slide elements, whereby the lathe is universally adapted to a wide range of work and is afforded an increased efficiency and ease of operative control.

In the drawings illustrating by way of example one embodiment of the invention:

Fig. 1 is an end elevation of my compound slide rest as viewed from the rear of the lathe bed, that is, looking from the left in Fig. 2;

Fig. 2 is a vertical section lengthwise said compound slide rest substantially centrally thereof and crosswise the lathe bed, as indicated by the line 2—2 of Fig. 3;

Fig. 3 is an end elevation opposite that of Fig. 1, as viewed from the front of the lathe bed, that is, looking from the right in Fig. 2, operating handles and shaft extensions being omitted in Fig. 3 for clearness;

Fig. 4 is a detail view in vertical section, corresponding to an upper right corner portion of Fig. 2, on a larger scale;

Figs. 5 and 6 are sections on the lines 5—5 and 6—6 respectively of Fig. 4;

Fig. 7 is an enlarged detail elevational view corresponding to a right central portion of Fig. 3, showing the relation of certain gears;

Fig. 8 is a vertical section lengthwise the compound slide rest, taken on a plane parallel to but behind that of Fig. 2, substantially as upon the line 8—8 of Fig. 9;

Fig. 9 is an end elevation substantially the same as Fig. 3, reproduced adjacent Fig. 8 for convenience in locating its sectional plane;

Figs. 10, 11 and 12 are enlarged detail views, in top plan, front, and side elevation respectively, of a clutch actuating element best seen in Figs. 16 and 17;

Figs. 13 and 14 are front and end elevations, on a similar enlarged scale, of an expanding element of said clutch of Figs. 10 to 12;

Fig. 15 shows a portion of the mechanism seen at the right central portion of Fig. 8, on a larger scale;

Fig. 16, on a similar scale as Figs. 10 to 15, corresponds to the lower right corner portion of Fig. 2, showing certain clutch mechanism;

Fig. 17 is a cross section substantially as on the line 17—17 of Fig. 16, with the spur gear in elevation;

Fig. 18 is a top plan of the main elements of my compound slide rest, with the rear of the lathe bed (that at the left in Fig. 2) at the bottom of the figure, said Fig. 18 particularly illustrating certain stop mechanism;

Fig. 19 is an end elevation of the mechanism of Fig. 18 as viewed from the right of the latter;

Fig. 20 is a front elevation corresponding to Fig. 18;

Fig. 21 is a view partly in end elevation (similarly as in Fig. 19) and partly in cross section, showing the mechanism of Fig. 20 as if viewed from the right therein, and on the line 21—21 of Fig. 18;

Fig. 22 is a partial vertical longitudinal section on line 22—22 of Fig. 18;

Figs. 23 and 24 are plan views of a portion of a stop motion for controlling the top slide of my compound mechanism, illustrating different positions and settings of said stop motion, for certain right-hand and left-hand operations respectively;

Figs. 25, 26, 27 and 28 respectively are an end view, a top plan, opposite end view and partial cross section illustrating details of a lower carriage element of the compound slide rest, Fig. 28 being taken substantially on the line 28—28 of Fig 26;

Figs. 29 and 31 are vertical sections lengthwise the lower carriage member of Fig. 26, on lines 29—29 and 31—31 respectively of said figure;

Fig. 30 is a cross section of the carriage of Fig. 26 substantially on the line 30—30 of said figure;

Figs. 32 to 37 relate to the lower slide of my compound slide rest, slidably mounted on the lower carriage of Figs. 25 to 31, Fig. 32 being a top plan, Fig. 33 a right end elevation, Figs. 34 and 35 being vertical cross sections on the similarly numbered section lines of Fig. 32, and Figs. 36 and 37 being views lengthwise of Fig. 32 partly in elevation and partly in vertical section as on the lines 36—36 and 37—37 of said Fig. 32;

Fig. 38 is an elevational assembly of the compound slide rest as a whole, as viewed from the back of the lathe, similarly as in Fig. 1 but with the top carriage and slide turned 90° from their position of Figs. 1 and 2, said Fig. 38 also including the headstock and adjacent end portion of the lathe bed, together with the back gears and main drive connections for the compound slide rest;

Fig. 39 is a plan of the top carriage of the slide rest, separately; and

Figs. 40 and 41 are vertical sections on the

lines 40—40 and 41—41, respectively, of Fig. 39.

From the drawings and the following description it will be evident that the compound slide rest of the present invention is adapted for use with any standard or preferred lathe. Accordingly it will be understood that the lathe bed 2 as represented partly diagrammatically in Figs. 2, 8 and 38, also the headstock and associated back gearing of said Fig. 38 are to be regarded as typical.

Referring to the drawings in more detail, and particularly to Figs. 1 to 3, 8, 9 and 38, the compound slide rest as a whole comprises four main elements, namely, a base or lower carriage 1 with a lower slide 18, and on the latter a rotary top carriage 80, herein fully rotatable through 360° relative to the underlying lower slide and carriage, and in turn slidably supporting a top slide 108 on which the various tools are mounted in the usual or preferred manner, as by means of one or more T-slots 108*a*, Figs. 1, 3, 9, 18, 19 and 21. A typical tool clamp 108*b* is shown in position on the top slide in Fig. 38.

This compound slide rest in its entirety is detachably mounted on the lathe bed 2, with capacity for adjustable positioning along it as desired, as by means of a stud 3 (Fig. 2) fixed on the lower carriage 1 and extending down through a slot running substantially its full length of the lathe bed. This stud and slot connection with the lathe bed permits the entire compound slide rest assembly to be set at any desired position along the lathe bed, the stud 3 moving in said bed slot. The slide rest as a whole is held in selected position lengthwise the lathe bed 2 as by turning up the knurled nut 4 (Fig. 2) on the lower end of the stud 3 into clamping engagement with the under face of the bed.

The lower carriage 1 is additionally held and guided on the lathe bed as by a beveled face at the upper rear edge of the latter, at the left in Fig. 2, which receives a like-inclined face on a depending lip 6 on the lower carriage. The front upper edge of the lathe bed has a like beveled face 8 engageable by a similarly inclined inner face on a guide plate 7 at the under face of the lower carriage and supported for adjusting movement, crosswise the lathe bed by T-headed studs 9 depending from and variably positionable lengthwise the lower carriage, to fit different widths of lathe beds, in downwardly open T-slots 10 and 11 in the under face of said carriage; see Figs. 3, 8, 28, 29 and 30. The projecting lower ends of said studs 9 are threaded to receive hand clamping levers 5, one of which is seen in Fig. 2. When these levers 5 are released the guide plate 7 may be pushed firmly against the inclined bed face 8, as permitted by the T-slot connection of the studs 9 with the lower carriage 1. Upon then turning up the levers 5 against the under face of the plate 7 the latter and hence also the lower carriage 1 are securely clamped against said bed face 8.

Still referring to Fig. 2, and also to Figs. 16 and 31, the lower carriage 1 has a longitudinal recess 1*a* housing a feed screw 13 for effecting movement of the lower slide 18, and hence of all parts on and above the latter, in the direction lengthwise the lower carriage 1 and transversely of the lathe bed 2. This feed screw is journaled at one end, at the left in Fig. 2, on the adjacent wall of the lower carriage 1 and at its other or front end in a separate end plate 12 demountably secured as by screws to the corresponding end face of said lower carriage; see also Figs. 26 and 27. Provision of such removable end plate 12 facilitates assembly and servicing operations. Near its rear end and within the lower carriage, Fig. 2, the feed screw 13 is held in the axial direction by a collar 16 pinned on it and engageable against the adjacent carriage wall, and by a retaining nut 14 and washer 15 on its projecting rear end.

This feed screw 13 has a spiral thread formation, substantially from end to end of the lower carriage 1 and receiving a like-threaded traveler or traversing nut 17. On the latter is an upright projection or post 82 (see also Figs. 27, 28, 30 and 31) for operatively connecting it with the lower slide 18. The feed screw 13 being held against endwise movement, turning thereof in one or the opposite direction causes the nut 17 to traverse lengthwise the screw and lower carriage 1 and thus correspondingly to move the lower slide 18 and all mechanism supported by it, along and upon the lower carriage 1.

Said turning of the feed screw 13 may be effected manually, as by the crank handle 19, Figs. 2 and 16, or by power-operated means, selectively, at the will of the operator. Accordingly the feed screw 13 has mounted on it, within and near the front end of the lower carriage 1, at the right in Fig. 2, a collar 22 fixed as by a set screw 23; see also particularly Fig. 16. Positioned on the feed screw 13 between this collar 22 and the end plate 12 is a spur gear or pinion 21, centrally recessed as at 24, Figs. 16 and 17. It is adapted to be clutched to the feed screw 13 to drive the latter, or to be released to turn freely on and without imparting motion to the feed screw at times when power operation of the latter is not desired, as determined by the lathe operator.

For said purpose I have herein illustrated an expanding clutch device, comprising a split expansion ring 25, shown on the larger scale in Figs. 16 and 17 and separately in Figs. 13 and 14. This expansion member 25 is housed in said central recess 24 of the gear 21, surrounds the adjacent portion of the feed screw, and is adapted to be spread into gripping engagement with the circumferential inner wall of said recess 24 by means of an expander or wedging member 26, carried by the feed screw 13 and slidably movable radially of the latter in a transverse recess 30 therein.

Said expander member 26 is shown separately in Figs. 10 to 12, and in operative position in Figs. 2, 16 and 17. It has a wedge-shaped head 26*a* for entering between the split end portions of the expansion ring 25 thereby to spread the latter, and has an actuating or cam face 27 at its inner portion. This cam formation 27 is operatively contactable by the conical inner end 29 of a clutch-operating rod 28 rotatably supported in an axial bore 31 leading in from the outer front end portion of the feed screw 13. Said portion of the feed screw projects outwardly beyond the end plate 12 of the bottom carriage 1, through a spacing and supporting sleeve-like boss 37 on said end plate, and preferably has a knurled knob or the like 36 for turning it to engage or disengage the clutch.

The front end portion of said axial bore 31 in the feed screw 13 is tapped as at 33, Fig. 16, for threaded engagement with a like-threaded forward portion 32 of the clutch-operating rod 28. The latter extends out beyond the feed screw and has a knurled operating nut 36 fixed on its projecting end. Means may be provided for securing this clutch rod 28 in selected adjusted position,

for clutching or unclutching the gear 21 relative to the feed screw. Such means is herein illustrated as a washer 34 and lock nut 35 on the clutch rod 28 and engageable against the end face of the feed screw. When this operating rod 28 is screwed in, the wedging member 26 on the feed screw is thereby thrust out into clutch-actuating position, expanding the ring 25 and locking the gear 21 to the feed screw so as to drive it, by the power connections to be described. By backing out said rod 28 the clutch is correspondingly disengaged and the gear 21 unclutched and left free to turn without imparting motion to the feed screw.

The described clutch-connectable and releasable gear 21 meshes directly with and is driven by an elongated or sleeve-like spur gear or pinion 39, Figs. 8, 15 and 29, constituting in effect the main driving pinion for the various motions of the compound slide rest as a whole.

For manually operating the feed screw 13 whenever preferred it is herein provided with a cross bar or crank 38, Figs. 2 and 16, fixed on its outer end as by the key connection 20 best seen in Fig. 16. This crank 38 carries the operating handle 19, Fig. 2, previously mentioned, conveniently accessible to an operator at the lathe front.

Considering further the elongated main drive pinion 39 and the power drive connections for it, said pinion 39 has a hub bearing 40 at its front end, at the right in Figs. 2, 8 and 29, rotatably supported in a bearing aperture 41 in the end plate 12 of the lower carriage 1. At its opposite end said pinion 39 is fixed on a pinion shaft 46 rotatable in an elongated bearing recess 47 at the rear portion of the lower carriage. Said pinion shaft 46 projects rearwardly beyond the lower carriage and there has driven connection with the power-operated main driving shaft 65 paralleling the lathe bed; see Fig. 1 and particularly Figs. 8 and 38.

Said main driving shaft 65 has bearing support in a suitable plurality of hangers 69 secured to the lathe bed as by screws 70. Two such hangers or bearing brackets 69 are seen in Fig. 38, near the respective ends of the lathe bed 2. The shaft 65 is extended beyond these bearing brackets, its projecting ends being reduced and threaded as at 71, 73 for the reception of retaining nuts 72 and 74 respectively.

At the headstock end of the lathe, that at the right in Fig. 38, the driving shaft 65 has removably keyed on it, between the adjacent bearing bracket 69 and the nut 74, a special back gear 75, adapted to mesh with and be driven by the customary train of back gearing 76, the latter being standard equipment for most lathes. Thus in the present embodiment of my invention said back gear train is utilized as the source of power for the several driven parts of the compound slide rest, when the person in charge of the lathe elects to utilize the power operation. It will be understood that the train of back gearing as represented more or less diagrammatically at 76 in Fig. 38 may include one or more change gears 76' ahead of the shaft 65 so that the latter may be driven in one or the opposite direction as desired and at the appropriate speeds.

The described main driving shaft 65, again as best seen in Fig. 38 and also in Figs. 1, 2 and 8, is provided with a longitudinal keyway 67 along substantially its full length. This enables the slide rest as a whole to be adjustably positioned at the desired location lengthwise the lathe bed, while maintaining the driven connection with the shaft 65.

Noting now more particularly Figs. 1, 2 and 8, the rear end face of the lower carriage 1 has removably secured to it as by screws 54 a combined bracket, gear guard and support 55, including opposed half-circular upper and lower gear-housing or guard members 50 and 51, the latter detachably secured as by screws 56 to the upper housing section 50 which in turn is herein integral with the bracket 55. This sectional gear housing 50, 51 is appropriately recessed centrally for passage of the shaft 65, with a sliding fit, so that the gear housing and its content may be shifted lenthwise the lathe bed 2 and along the shaft 65 together with the compound slide rest as a whole. Within the housing 50, 51 is the main driving gear 57, Fig. 8, also slidable on the shaft 65 but at all times having driven connection with it by means of a tenon or key 66 fixed on the gear hub but having a sliding fit in the driveshaft keyway 67. Positioning faces 59, 59, Fig. 1, at the opposite inner portions of the drive gear housing 50, 51 hold said gear 57 in the direction lengthwise the shaft 65, in the position along it as determined by the selected location of the compound slide rest as a whole along the lathe bed.

This drive gear 57, preferably of the spiral type, has driving engagement with a smaller and also preferably spiral intermediate gear 60. The latter is rotatably mounted on a short shaft 61 fixed as by pins 62, 62 in an upright extension 50*a* (Figs. 1 and 8) of the upper housing member 50 already described. The intermediate gear 60 in turn meshes with a similar and preferably spiral gear 99 keyed on the reduced outer end 48 of the pinion shaft 46 already described, and at the other end of which the elongated drive pinion 46 is fixed.

The gear housing extension 50*a* already referred to has a bearing aperture as at 49 for said end 48 of the pinion shaft 46, and the gear 99 is held on the latter between the shoulder of its reduced end 48 and an end bearing boss 52 in said housing extension 50*a*. The latter may also provide opposed end bearing formations 53, 64 at the opposite faces of and thereby positioning the intermediate gear 60 on its short shaft 61.

To this point I have described in detail the lower carriage 1, upon which the entire mechanism of my compound slide rest is mounted, together with the provisions for operatively securing this lower carriage and hence the slide rest as a whole at any selected point lengthwise the lathe bed; also the driving connections from the lower source, in this instance the back gearing at the headstock end of the lathe, up to the elongated drive pinion 39 disposed in the lower carriage 1 and from which pinion power is transmitted for automatically actuating various parts of the compound slide rest, at the will of the operator. I have also described, with particular reference to the lower right corner portion of Fig. 2 and to Figs. 16 and 17, the means (herein including the feed screw 13 and associated connections) for selective manual or power control and operation of the lower slide 18 whereby it and all parts on and above it are traversed lengthwise the lower carriage, in the right and left direction with reference to Figs. 2, 8 and 38; that is, crosswise of the lathe bed.

The invention further contemplates novel supporting and driving mechanism through which the top slide and carriage assembly may be set to any angle about a vertical axis throughout a full

360° of arc, and also by which, again at the option and under the selective control of the lathe operator, the top slide 108 may be caused to move along and upon the top carriage 80, radially of its vertical axis, in any angular position to which they are adjusted relative to the lathe bed and to the lower carriage and slide unit.

Noting particularly Figs. 2 and 8, the lower slide 18 has a vertically recessed portion 77 disposed intermediate its ends, herein nearer its front end. Said recess 77 extends vertically through the slide 18 and receives various of the operating parts now to be described. It is also seen in detail in several of Figs. 32 to 37, noting particularly Figs. 34 and 37. Said parts received by it include the main pivotal and bearing element or pivot bearing disk 78 for the top carriage 80; see also Figs. 39 and 40.

This pivot and bearing disk 78 is firmly fixed against the underface of the top carriage 80 as by means of screw bolts 79 herein assisted by a central boss 89 at the top of the bearing disk and seating in a like recess in the top carriage underface. At its bottom face said pivot-bearing 78 is centrally bored as at 81 (Fig. 40) for rotative reception of the upright projection or post 82 on the traveler nut 17 already described in connection with the lower carriage 1. The upper portion of said lower slide recess 77 is formed as a vertically disposed collar bearing for said top carriage pivot disk 78.

The horizontal boss-like top end face 83 of said pivot-disk bearing, see Figs. 8, 37 and 2, provides an under bearing surface for a double ring gear 85, loose on but positioned by the pivot-bearing disk 78 and held in place vertically between said bearing face 83 and the underface of the top carriage 80.

This double ring gear 85 accordingly is securely positioned but is afforded capacity for rotation, relative both to the lower slide 18 and to the top carriage 80, about the bearing disk 78 as its vertical axis. The lower annular gear portion or toothed ring element of this double ring gear 85 meshes with and is driven by a relatively small bevel gear 86 integrally or otherwise unitarily connected to a spur gear 87, of about the same size as said bevel gear 86. This gearing unit 86—87, preferably formed of one solid piece of metal, is rotatably mounted on a stud shaft 92, see particularly Fig. 2, extending in the direction lengthwise the lower slide 18 and fixed in an appropriate recess therein as by a set screw 90.

As previously indicated, the invention includes means for rotatively adjusting the entire top carriage and slide unit 80—108 relative to the under carriage and slide unit and hence relative to the lathe bed and to the work. And in combination with such rotative adjusting capacity, means is provided, herein through the medium of the described gear unit 86—87 and the associated ring gear 85, and adapted to be rendered operative or inoperative at the operator's will, for connecting them with the power source and drive connections, herein through the elongated drive pinion 39 of the lower carriage 1, thereby to afford a power drive for the top slide.

Accordingly the lower slide 18 carries at a location laterally adjacent the gear unit 86—87 and its stud shaft 92, an adjustably slidable shaft 93, seen at the lower right in Fig. 8 and in detail on a larger scale in Fig. 15; also in top plan and in association with the gearing unit 86—87 in Fig. 32. At its inner end this sliding shaft 93 carries an intermediate gear 91 having a hub 100 pinned at 164 to said shaft. This gear 91 is at all times in mesh with the elongated drive pinion 39; see particularly Figs. 3, 7 and 9. Depending on the adjusted position of the sliding shaft 93, in the right and left direction in Figs. 8 and 15, said gear 91 will be aligned with and in meshing driving relation to the spur-gear portion 87 of the gear unit 86—87 on shaft 92 (Figs. 2 and 32), or will be withdrawn from such driving relation.

Desirably automatic means is provided for releasably holding the slide shaft 93 in either of said adjusted positions. For this purpose I have here shown, as best seen in Fig. 15, a ball detent 96 loaded by a spring 97 housed in the lower slide 18 and there held in place as by a screw plug 98. The slide shaft 93 has a pair of spaced circumferential grooves 94, 95 located to come opposite the ball detent 96 in the inoperative and operative positions of the gear 91 respectively. In either of said positions the ball detent 96 automatically snaps into holding relation in the appropriate groove 94 or 95, thereby preventing unintentional displacement of the slide shaft 93. The latter herein is equipped with a knurled head 102 as a convenient gripping device for pushing it in or withdrawing it, thereby to engage or disengage the gear 91 in the manner described.

As shown in detail in Figs. 32 and 34, locking or clamping means is provided intermediate the lower slide 18 and the top carriage 80, for releasably setting or retaining the latter in any desired angular relation to the lower slide and carriage, throughout the entire available swing of 360°.

Such means herein comprises a lock stud or clamping pin 105 having an inner end formation conforming to the adjacent annular portion 106 (Fig. 40) of the pivot-disk 78, said portion 106 herein being a lower beveled flange at the base of said disk. This rotary locking member or set-pin 105 has a threaded portion 104, Fig. 34, received in a like threaded side edge portion of the lower slide 18; see also Fig. 32. At its outer end is a manipulating handle 105 conveniently available to the operator. By turning this handle to screw in or to back out the set-pin 105 the top carriage and all parts carried by it may be located in fixed angular relation to the underlying lower slide and carriage unit 18—1, or quickly freed for further rotative movement.

To assist in thus setting or resetting the top carriage the latter desirably is provided with a graduated ring 107 having an upwardly facing beveled outer face conveniently graduated in degrees and subdivisions. This graduated ring 107 is fixed to the underface of the carriage 80 as by a number of screws 110, four in this instance, indicated in dotted outline in Fig. 1 and seen also in Figs. 39 and 41.

The top carriage 80, as already noted, carries the top slide 108 on which the tool-holder such as 108*b* of Fig. 38 is itself mounted, in one or the other or both slots 108*a*. The guiding support for this top slide 108 on its top carriage 80 may be generally similar to that for the lower slide 18 on its carriage 1, including the usual undercut beveled guide and way connections evident in the end views of Figs. 1, 3, 9, 19 and 21.

For slidably moving the top slide 108 on and relative to its carriage 80, the latter is provided with an elongated feed screw 111 receiving a like-threaded traveler or drive nut 136 having a top projection or post 137 fitted in a like aperture at the underface of the top slide

108 and there secured as by the screw 138; Fig. 2. These main parts of the feeding or traversing mechanism for the top slide, and their manner of mounting in the top carriage 80, also may be generally similar as for the corresponding feed screw 13 and traveler nut 17 of the lower carriage and slide. Thus the top-slide feed-screw 111 extends the length of the top carriage 80 in a suitable recess 80a therein, Fig. 2, and projects at both ends of said top carriage.

That end of the top carriage and slide at the right in Fig. 2 is herein referred to as their front end. It is their end which is at the front of the lathe when the top carriage is in its usual position crosswise the lathe bed and paralleling the lower carriage and slide, as in Figs. 1 to 3. Said position of the top carriage 80 represents the zero setting of its graduated dial 107. It will be understood however that in the course of the numerous available lathe operations the top carriage and slide unit 80—108 may be set at any desired angular relation to the lower carriage and slide unit 1—18, throughout the entire 360° circumference of the graduated ring 107. For example, in Fig. 38 the top carriage and slide unit 80—108 are shown turned 90° from their Fig. 2 position, so that they parallel the lathe bed 2 and are at right angles to the lower carriage and slide unit 1—18, as appropriate for thread-cutting operations, among others.

At its front end the feed screw 111 has bearing support in a bushing 126 extending through a detachable front end plate 125 for the top carriage 80, said plate being secured to the latter as by screws 140, four of which are shown in Figs. 18 and 19; see also Figs. 2, 3 and 21. For hand operation of this top-slide feed screw 111, as seen in Figs. 2 and 38, its projecting front end is equipped with a crank or cross bar 127 having a handle 128. This hand-operating means 127, 128 has a key connection at 129 with the feed screw 111 and is held in place thereon as by a washer 130 and retaining nut 131. At its opposite or rear end the feed screw 111 is journaled in a suitable bearing aperture 139 in the adjacent rear end wall of the top carriage 80. Movement of the feed screw 111 in the direction of its axis is prevented as by a collar 132 pinned at 133 on the feed screw inwardly of its bearing 139, and by a washer 134 and retaining nut 135 threaded on its projecting rear end.

The top-slide power-drive connections, for driving the feed screw 111, herein include a bevel pinion 112 loosely mounted on said screw and having constant meshing relation with the upper toothed ring element of the double ring gear 85 already described. Rotation of said ring gear 85, through the pinion and gear unit 86—87 and the slidable release gear 91 meshing with the elongated main drive pinion 39, accordingly imparts rotation to said screw-carried pinion 112 and thence to the feed screw 111 itself, through an automatically operable clutch device to be described.

This feed-screw pinion 112 is held against inward movement along the feed screw as by a collar 113 fixed by a set-screw 114. As seen in Fig. 2 and on a larger scale in Fig. 4, said feed-screw pinion 112 has a forwardly extended hub, the front end of which is centrally bored to receive a further positioning collar 115, holding the pinion 112 against axial displacement in the other direction, that is, outwardly, toward the right in Figs. 2 and 4. This latter collar 115 is fixed on the feed screw as by a set-screw 116, the top carriage desirably having an aperture 117 in its top wall vertically over said set-screw 116 for screwdriver access to it; see also Figs. 18 and 22. It is again particularly noted that the feed-screw pinion 112, while held against endwise displacement upon the feed screw 111, is rotatively loose on the latter, so that the pinion, as determined by the position of the associated clutch mechanism and automatic stop means to be described, may at times turn freely on and relatively to the feed screw, leaving the latter at rest, and at other times may be clutched to the feed screw to drive it.

Again as seen in Fig. 2, on an intermediate scale in Fig. 22, and on a still larger scale in Figs. 4 to 6, such clutch mechanism herein comprises a projecting clutch element or lug 118 at the front or outer face of the hub of the feed-screw pinion 112. This clutch element 118 is adapted for cooperation with a similar but oppositely projecting clutch element or lug 119 on a clutch yoke or spool 123 non-rotatively but slidably keyed on the adjacent portion of the feed screw 111 as at 124. It will be understood that axial sliding movement of the yoke 123 toward the left in Figs. 2, 4 and 22 will cause this positive clutch device 118, 119 to be shifted from its inactive or non-clutched position shown in said fingers to an active or clutched position. In said clutched position, in which the elements 118, 119 stand in the same plane transversely of the feed screw, rotation of the pinion 112 is positively transmitted to said screw.

Such shifting of this top-slide feed-screw clutch herein is effected by a vertical pin 120 on a clutch shifting or trip lever 162 to be described, the lower end of said pin standing in a circumferential groove 122 in the clutch yoke 123. Vertically opposite this clutch yoke the top carriage 80 is appropriately recessed as at 121, Fig. 4 (see also Figs. 18 and 39) to permit the described clutch-engaging or releasing movement of the pin 120.

The clutch shifting or trip lever 162 carrying the yoke-engaging pin 120 is shown in detail in Figs. 18 to 24, being also seen in section in Fig. 2 and in end elevation in Fig. 38. Referring more particularly to said Figs. 18 to 24, the front end portion of the top carriage 80, adjacent its end plate 125, has sunk in its top face, a small pivot-positioning plate 141 for the trip lever 162, said plate being removably held on the top carriage as by a screw 144; Figs. 18, 19 and particularly Fig. 39. The trip lever 162 extends substantially across the top carriage 80, with one end near or overlying the plate 141 (depending on the lever-pivot setting) and its other end projection at the opposite side of said carriage.

As will best be understood in connection with the partly diagrammatic Figs 23 and 24, the trip lever 162 is adapted to be pivotally anchored on the top carriage, for horizontal swinging movement, in either of two pivot positions. The clutch-yoke shift-pin 120 is fixed in the trip lever 162 somewhat nearer to one end, that adjacent the anchor plate 14, than to the other. The two pivot positions are at opposite sides of said yoke-pin 120, in the direction lengthwise the trip lever 162, the latter having the alternative pivot-screw-receiving apertures 142 and 146 defining said positions.

From the foregoing it will be understood that the trip lever 162 forms a part of the automatic stop motion, for predeterminedly throwing out

the top-slide feed-screw clutch and so to halt the traversing movement of the top slide 108, under power actuation of the latter. For some operations, such as cutting right-hand threads, the movement of the top slide is in a given direction, as from right to left in Figs. 18, 20 and 38 (the latter a view from the rear of the lathe). At other times, as for left-hand thread cutting, the top slide movement is the opposite, as from left to right in said figures. But since the clutch-releasing movement of the clutch yoke 123 is always in the same direction, namely, from left to right in the figures under consideration, the selective pivot position for the trip lever 162 is herein provided so that swinging of this trip lever in either direction, corresponding to the direction of top-slide movement, will communicate the same herein left-to-right clutch-throwout movement to the yoke-pin 120 and clutch yoke 123.

Accordingly the central pivot-screw aperture 146 in the trip lever 162 is utilized for automatic stop control under right-to-left operations of the top slide. The setting is then as in Figs. 18, 19 and particularly Fig. 23. The removable pivot screw 145 is here positioned in said lever aperture 146 and turned down into an anchoring aperture 147 tapped vertically into the upper face of the top carriage 80 at the appropriate location for the purpose.

For automatic stop control under conditions of opposite movement of the top slide, from left to right in Figs. 18 and 20, the same pivot screw 145 is removed from pivot-aperture 146 of the trip lever and installed in the end aperture 142, being turned down into a tapped aperture 143 provided for this purpose in the removable plate 141. Such pivot setting is represented in Fig 24.

The trip lever 162 cooperates with variably positionable stop devices on and moving with the top slide 108, as will be described. The projecting end of said trip lever, that at the lower portion of Figs. 18, 23 and 24, will be referred to as the stop-actuated end. By comparing Figs. 23 and 24 it will be noted that in Fig. 23 the lever pivot screw 145 is fixed at a position between said stop-actuated end and the clutch-yoke pin 120. Movement of said projecting stop-actuated end of the trip lever from right to left (Fig. 23) accordingly moves the clutch-yoke pin 120 in the desired clutch-throwout direction, from left to right. In Fig. 24 however the lever pivot screw 145 is disposed at the opposite side of said yoke pin, remote from the stop-actuated end of the trip lever, the yoke-pin now standing between the lever pivot and said stop-actuated lever end. Consequently under this Fig. 24 setting, movement of this stop-actuated end of the lever in the direction from left to right (opposite to its movement in Fig. 23) still effects a left-to-right movement of the clutch-yoke pin 120, in the desired clutch-throwout direction

The variably positionable top-slide-actuated stop devices above mentioned will now readily be understood with little further detailed description. Referring still to Figs. 18 to 24, also Fig. 38, the top slide 108 is provided with a threaded stop bar 148, itself adjustably positionable on and along the top slide and adjustably carrying a stop device or stop proper comprising a pair of knurled nuts 150, 150. Depending on the direction of top slide travel, whether from right to left or vice versa, either the left or the right nut 150 of this stop pair respectively will act as the lever-contacting stop or abutment, the other nut 150 serving as a lock.

The stop bar 148 is adjustably mounted at a longitudinal side face of the top slide 108 in a bearing bracket 151 secured to the slide by screws 152. It has a sliding fit in this bracket 151 so as to be bodily adjustable lengthwise relative to the top slide. For fixing this stop bar 148 in adjusted position the bracket has a set screw 153; also a pair of knurled lock nuts 154, 155, are threaded on the stop bar and adapted to be turned up against the opposite sides of the bearing bracket 151. To facilitate the description the two opposite ends of the stop bar 148, at the left and at the right respectively in Figs. 18 to 24, are identified by the numerals 157 and 163. It will also be noted that what has been referred to as the projecting or stop-actuated end of the clutch trip lever 162 is in the form of a collar or sleeve having a transverse passage 149 for this stop bar 148, with adequate clearance to permit the angular movement of the trip lever 162 relative to the stop bar as evident in Figs. 23 and 24.

In Figs. 18 and 20 the trip lever 162 is shown in a neutral position, with the stop nut pair 150 located near it and adjacent the right end 163 of the stop bar 148. This positioning of the parts is merely arbitrary, being selected as convenient for illustrating their structure. It could be assumed, however, in comparing Fig. 18 with Fig. 23, that in Fig. 18 the top slide 108 occupies a position half way between that corresponding to the full-line clutch-engaged position of the lever 162 in Fig. 23 and that corresponding to the dotted-line clutch-released lever position of that figure.

It will now be apparent that in setting up or adjusting the compound slide rest for power-driven actuation of its top slide 108 and under the automatic control of the described stop mechanism it is a simple matter to effect a changeover from right-hand operations as in Figs. 18, 20, and 23, involving travel of top slide from right to left therein, to left-hand operations and top slide travel from left to right as assumed in Fig. 24. In this connection it will be understood that the change gearing previously referred to in connection with the back gearing 76 of Fig. 38 is so regulated that the main drive shaft 65 through which the power is transmitted to the entire compound slide rest, is rotated in one or the opposite direction as appropriate to the particular operation.

In addition to such shift of the change gearing between the main drive shaft 65 and the power source, whatever the latter may be in any given lathe installation, such changeover from right-hand to left-hand top-slide operation under automatic stop control, that is, from an operation as in Figs. 18, 20, 23 to that of Fig. 24, it is merely necessary to remove the trip-lever pivot-screw 145 from its Fig. 23 location in the intermediate lever-pivot aperture 146, and to relocate it in the end pivot-aperture 142 and turn it down into threaded aperture 143 provided for the purpose in the plate 141. Also, the stop nut pair 150 is adjusted inwardly along the stop bar 148, from the right end 163 of the latter toward an intermediate location, such as that which they occupy in Fig. 24.

To accomplish this, said pair of stop nuts 150, 150 is backed completely off to the right end 163 of the stop bar, and the latter is pulled out to the left clear of the trip lever 162. At such time the right lock nut 155 adjacent the bearing bracket 151 is backed over to the right to

the required extent. The lock nut pair 150 is then replaced on the stop bar and turned along on it to the appropriate intermediate location, which may be closely adjacent to said lock nut 155. The stop bar 148 is then reinserted through its aperture 149 in the trip lever 162 and again firmly secured by turning down the set screw 153, previously released to make the described adjustment, and by turning up both lock nuts 154 and 155 tightly against the respective side faces of the bearing bracket 151. This provides a stop setting as typified in Fig. 24. It will be obvious that in such change from a right-hand to a left-hand operation of the top slide 108, or vice versa, the slide itself will be appropriately shifted along its top carriage 80, as from a position nearer the left end thereof for a left-to-right operation, to a location nearer the right end of the carriage, for a right-to-left operation. This positioning of the top slide may be effected manually by the handle 128. Where the particular job requires a comparatively long travel for the top slide it also will be appreciated that the stop bar 148 may be itself bodily shifted lengthwise the top slide to any necessary extent within the capacity of the mechanism. For example, in a set up for a rather extreme top slide travel from left to right, the major length of the stop bar 148 may lie to the right of the top slide, with the left stop-bar end 157 at or near the left lock nut 154.

Under the described power-driving and automatic stopping of the top slide, its movement continues until the predeterminedly set stop-nut pair 150 contacts and swings the clutch trip lever 162 to disengage the clutch elements 118, 119 and hence to release the feed-screw pinion 112 from the feed screw, whereupon rotation of the latter halts, bringing the top slide to rest. From the previous comparison of Figs. 23 and 24 it will be understood that such throwout of the clutch device 118, 119 is accomplished irrespective of whether the pair of stop nuts 150 comes into abutment with the right side of the trip lever 162 and hence to swing it to the left as in Fig. 23, or similarly engages the left side of the trip lever to swing it to the right as in Fig. 24. Due to the different location of the trip-lever pivot 145 for said different directions of top-slide travel, the releasing action at the clutch device 118, 119 is the same.

The universal adaptability of my compound slide rest to substantially any standard lathe, and the wide range of operations available, selectively under manual or power actuation, will now be apparent from the foregoing description and reference to the drawings.

To mention but a few typical operations, assume now that the job is to cut or grind a radial face, as for example in facing off a casting secured to the lathe face plate. If this is to be done manually the power source is disconnected from the main drive shaft 65 as by appropriate adjustment or removal of the change gearing herein associated with the back gearing 76. The top carriage is set angularly in the zero position of its dial 107, with both top and bottom carriage-and-slide units parallel and crosswise the lathe bed as in Fig. 2. The top carriage is clamped in this position, by turning up the screw clamp 103—105. The entire compound slide rest is bodily shifted along the lathe bed to bring the tool on the top slide appropriately adjacent the work, the rest as a whole being freed for movement to and being secured in said position along the lathe by manipulation of the bed nut 4 and clamping handle 5.

With the lathe then started up to rotate the work, turning of the lower carriage feed-screw handle 19, herein in the clockwise direction as viewed from the right in Fig. 2 or as looking at the end view of Fig. 3, will traverse the lower carriage 18 together with all parts on and above it, including the appropriate grinding or cutting tool, in the direction across the lathe bed and across the rotating work.

To perform the same operation under power actuation the compound slide rest assembly as a whole is similarly set at the appropriate position lengthwise the lathe bed, and the change gearing is adjusted to apply power to the main drive shaft 65, herein from the back gearing 76, and so as to turn the lower carriage feed-screw 13 in the same direction as above done manually, that is, clockwise in Fig. 3.

In setting up for this power operation, the several clutch devices initially are released. These include the lower expanding-clutch pinion 21 on the lower feed screw 13 as controlled by the knurled knob 36 adjacent the handle 19 of said screw, the double-ring-gear clutch or release device 136, 137 controlled by pulling out or pushing in the knob 132, and the automatic stop-control clutch 118, 119 of the top feed-screw pinion 112. With these clutch devices released the lathe is started up. The lower feed-screw clutch, associated with the pinion 21, is then engaged, by turning in the knurled operating knob 36 and setting up its lock nut 35. Thereupon the lower carriage and all parts on and above it will traverse across the lathe bed automatically under power as herein derived from the lathe back gearing 76, rather than under the manual actuation of the hand crank 19.

Under such automatic drive the power transmission, starting with the main drive shaft 65 or its end gear 75 associated with the back gearing 76, is from this drive shaft, through the spiral gearing 57, 60, 99 onto the shaft 46 of the elongated drive pinion 39, and from the latter to the clutch pinion 21 then clutched to the feed screw 13 by the setting of the pinion-clutch control 36 in the manner described.

For operations such as cutting threads, the cutting tool is to be traversed lengthwise the lathe bed, along and parallel to the axis of the rotating work such as a shaft, rod or the like. For such job, the top carriage 80 of my compound slide rest is turned to a position such as represented in Fig. 38, at right angles to the under carriage and paralleling the lathe bed 2. Because of the human factor it is desirable to perform such operations as thread cutting solely under the power control of the lathe itself, but it will be understood that the power-actuated operation now under consideration may, if desired, be effected manually by turning the top feed-screw by hand, the power connections being released.

Referring again to Fig. 38, assume that the change gearing adjacent the back gearing 76 is set to drive the shaft 65 in the desired direction. The top carriage is set to the 90° angular relation of Fig. 38 and there locked by turning up the clamp 103—105. The several clutch devices are initially released and the automatic stop mechanism associated with the stop shaft 145 is appropriately set, as typified in Figs. 23 and 24 in connection with cutting a right-hand or a left-hand thread respectively. For this

typical screw-cutting operation the lower feed screw clutch controlled by the knurled knob 36 remains released throughout, being locked in such position by its lock nut 35, so that the clutch pinion 21 merely turns idly on the lower feed screw 13.

With the lathe turning, the double-ring-gear clutch device is caused to engage, by slowly pushing in the knurled knob 102 and hence engaging the pinion 87 of unit 86—87 with the intermediate pinion 91 meshing with and driven by the elongated drive pinion 39. It will be understood that in setting the automatic stop mechanism the top feed-screw clutch lever 162 was shifted into its clutch engaging position, making the pinion 112 fast with respect to the top feed screw 111. Hence, upon so positioning the knurled knob 102, power is applied to said top feed screw 111 and the top slide 108 is caused to travel along the top carriage 80, until stopped by the automatic tripping of the clutch lever 162. It is also an important feature that this top feed-screw clutch-lever 162 may likewise be shifted manually, at any desired time, to disengage the top feed-screw clutch elements 118, 119 and hence to stop movement of the top slide at will.

Under such power-driven operation of the top slide, either under automatic or manual stop control, the line of power transmission again is from the power source whether the back gearing as herein illustrated or otherwise, onto the main drive shaft 65 and through the spiral gearing as before, to the elongated drive pinion 39 which drives the intermediate gear 91, now in mesh with the spur gear 87 integral with the bevel gear 86. The latter drives the double-ring-gear 85, through its lower toothed ring member, while its upper toothed ring element in turn drives the bevel pinion 112, now clutched to the top feed screw 111 through the engaged clutch elements 118, 119. Thus the top feed-screw nut 136 is caused to travel lengthwise its feed screw 111 of the top carriage, moving the top slide 108 with it, until the predeterminedly set stop-nut pair 150 contacts and trips the clutch lever 162, or until the latter is manually thrown, as the operator may desire.

It is here again particularly emphasized that the top carriage and its slide, as a unit, may be set at any desired angle relative to the lower carriage and slide unit, throughout the entire 360° of arc about the pivot bearing of the top carriage. The particular 90° setting shown by way of example in Fig. 38 is but one of the full 360° range of angular settings available. Thus for example a taper of any prescribed degree may be cut or ground by setting the top unit to the appropriate angle, anywhere within the full 360° swing, and as readily ascertained by reference to the graduated dial on the top carriage. And in whatever angular position the top carriage is set for a particular job, its top slide is equally capable of power actuation and of automatic stop control, in either direction of travel, and likewise in any such angular setting over the full 360° range it is available also for manual operation and control at the operator's will.

Heretofore so far as I am aware, no similarly coordinated compound slide rest has been provided, applicable uniformly to the generality of standard or preferred lathes and having integrally built into and permanently associated with it driving and control mechanism whereby driving power may be applied from any available source, such as the back gearing of the lathe, either to the lower or to the upper carriage and slide units. Thus power operation is always available not only for the lower slide but also for the top slide, together with provision for automatic stop control of the latter, as appropriate for example in the cutting of threads, either right-hand or left-hand. And in the disclosed construction and arrangement such units or slide elements may readily be connected to or disconnected from the power source, so as to leave one or another element or unit at rest, or to render them available for manual operation, at the option and under the control of the operator. These and other results and advantages which will now be apparent from the disclosure herein are accomplished with a marked simplicity and compactness of mechanism and at relatively small cost in consideration of the wide increase in range of usefulness and greater speed of operation hereby made possible for existing and future lathes.

My invention is not limited to the particular embodiment thereof illustrated and described herein, and I set forth its scope in my following claims.

I claim:

1. A compound slide rest adapted for detachable association with standard and other lathes, comprising, in combination, a lower carriage variably positionable along a lathe bed, adjustable means for securing said carriage and the rest as a whole in selected position on the given bed, said means including spaced depending members on said carriage relatively variably positionable crosswise of a lathe bed for clamping engagement with opposite side portions of such beds of different widths, a lower slide traversable lengthwise on the lower carriage, traversing mechanism for the lower slide, manual means for actuating said traversing mechanism, power-drive connections also for actuating said traversing mechanism and including means available during normal use of the slide rest for rendering said connections operative or inoperative at will, said means readily available to the operator at all times irrespective of the operating status of the lathe and slide rest as a whole, an upper assembly mounted on the lower slide for full rotative adjustment relative thereto about a vertical pivot and comprising a top carriage and a top slide movable on the latter, and selectively manual and power operative mechanism for traversing the top slide on its carriage radially of the vertical pivot thereof and in any and all positions of rotative adjustment of said upper assembly.

2. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage adapted for fixing upon a lathe bed in variable position along it, means for securing said carriage both vertically and horizontally on and in relation to the given bed, said means including spaced depending members on said carriage relatively variably positionable crosswise of a lathe bed for clamping engagement with opposite side portions of such beds of different widths, a power-transmitting shaft mounted on and extending lengthwise the lathe bed, said power shaft having means near one end for connecting it with an available power source at the lathe and so as to be driven in one or the opposite directions selectively, a main drive pinion for the slide rest journaled in said lower carriage, gearing connections between said main drive pinion and the power shaft, said gearing connections carried by the lower carriage and being shiftable along the lathe bed with the lower carriage and relative to the power shaft, a

lower slide movable on the lower carriage, a manually operable feed screw rotatable in the lower carriage and having a traveler nut secured to the lower slide, gearing intermediate the main drive pinion and said lower carriage feed screw for optional power drive of the latter thereby to move the lower slide, and clutch mechanism including control means therefor to render said last-named gearing operative or inoperative at will.

3. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage adapted for fixing upon a lathe bed in variable position along it, a power-transmitting shaft mounted on and extending lengthwise the lathe bed, said power shaft having means near one end for connecting it with an available power source at the lathe and so as to be driven in one or the opposite direction selectively, a main drive pinion for the slide rest journaled in said lower carriage, gearing connections between said main drive pinion and the power shaft, said gearing connections carried by the lower carriage and being shiftable along the lathe bed with the lower carriage and relative to the power shaft, a lower slide movable on the lower carriage, a manually operable feed screw rotatable in the lower carriage and having a traveler nut secured to the lower slide, clutch-controlled gearing intermediate the main drive pinion and said lower carriage feed screw for optional power drive of the latter thereby to move the lower slide, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, feed screw and traveler nut connections on the upper unit for moving the upper slide on the upper carriage radially of said vertical axis and in any angular position of said upper unit, and selective manual and power means for so moving the upper slide on its carriage irrespective of their angular position relative to the lower slide.

4. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage adapted for fixing upon a lathe bed in variable position along it, a power-transmitting shaft mounted on and extending lengthwise the lathe bed, said power shaft having means near one end for connecting it with an available power source at the lathe and so as to be driven in one or the opposite direction selectively, a main drive pinion for the slide rest journaled in said lower carriage, gearing connections between said main drive pinion and the power shaft, said gearing connections carried by the lower carriage and being shiftable along the lathe bed with the lower carriage and relative to the power shaft, a lower slide movable on the lower carriage, a manually operable feed screw rotatable in the lower carriage and having a traveler nut secured to the lower slide, clutch-controlled gearing intermediate the main drive pinion and said lower carriage feed-screw for optional power drive of the latter thereby to move the lower slide, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, feed screw and traveler nut connections on the upper unit for moving the upper slide on the upper carriage radially of said vertical axis and in any angular position of said upper unit, a ring gear element mounted concentrically of the upper unit axis and rotatable relative to both the upper unit and the lower slide, gearing connections between the main drive pinion in the lower carriage and said ring gear element including means to render said connections operative or inoperative at will, and clutch-controlled gearing connections between said ring gear element and the feed screw of the upper unit for selectively moving the top slide on its carriage by power from said power shaft.

5. In a compound slide rest attachment for a lathe, in combination, a lower carriage having a slide movable on it, an upper carriage also having a slide movable thereon, a vertical pivot disk fixed at the under face of the upper carriage and having rotative bearing support in and upon the slide of the lower carriage, a double ring gear positioned by said pivot disk for rotation relative to it, means to move the lower slide on its carriage, means on the upper carriage for moving its slide thereon, a main power-operable drive element on the lower carriage and clutch-controllable gearing connections respectively between said drive element and the double ring gear and between the latter and the means for moving the upper slide.

6. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage adapted for fixing upon a lathe bed in variable position along it, a power-transmitting shaft mounted on and extending lengthwise the lathe bed, said power shaft having means near one end for connecting it with an available power source at the lathe and so as to be driven in one or the opposite direction selectively, a main drive pinion for the slide rest journaled in said lower carriage, gearing connections between said main drive pinion and the power shaft, said gearing connections carried by the lower carriage and being shiftable along the lathe bed with the lower carriage and relative to the power shaft, a lower slide movable on the lower carriage, a manually operable feed screw rotatable in the lower carriage and having a traveler nut secured to the lower slide, clutch-controlled gearing intermediate the main drive pinion and said lower carriage feed screw for optional power drive of the latter thereby to move the lower slide, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, feed screw and traveler nut connections on the upper unit for moving the upper slide on the upper carriage radially of said vertical axis and in any angular position of said upper unit, selective manual and power means for so moving the upper slide on its carriage irrespective of their angular position relative to the lower slide, and variably positionable automatic stop means for predeterminedly halting the top slide at the desired point and for either direction of movement thereof.

7. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage adapted for fixing upon a lathe bed in variable position along it, a power-transmitting shaft mounted on and extending lengthwise the lathe bed, said power shaft having means near one end for connecting it with an available power source at the lathe and so as to be driven in one or the opposite direction selectively, a main drive pinion for the slide rest journaled in said lower carriage, gearing connections between said main drive pinion and the power shaft, said gearing connections carried by the lower carriage and being shiftable along the lathe bed with the lower carriage and relative to the power shaft, a lower slide

movable on the lower carriage, a manually operable feed screw rotatable in the lower carriage and having a traveler nut secured to the lower slide, clutch-controlled gearing intermediate the main drive pinion and said lower carriage feed screw for optional power drive of the latter thereby to move the lower slide, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, feed screw and traveler nut connections on the upper unit for moving the upper slide on the upper carriage radially of said vertical axis and in any angular position of said upper unit, a ring gear element mounted concentrically of the upper unit axis and rotatable relative to both the upper unit and the lower slide, gearing connections between the main drive pinion in the lower carriage and said ring gear element including means to render said connections operative or inoperative at will, clutch-controlled gearing connections between said ring gear element and the feed screw of the upper unit for selectively moving the top slide on its carriage by power from said power shaft, and variably positionable automatic stop means for predeterminedly halting the top slide at the desired point and for either direction of movement thereof.

8. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage, releasable securing means for fixing said carriage on a lathe bed in variable position along it, said means including spaced depending members on said carriage relatively variably positionable crosswise of a lathe bed for clamping engagement with opposite side portions of such beds of different widths, a drive shaft on and extending lengthwise the lathe bed, an initial driven element on the slide rest, gearing connecting said driven element and the drive shaft in any position of the slide rest along the lathe bed, a lower slide movable on the lower carriage crosswise the lathe bed, clutch-controlled gearing between the initial driven element and the lower slide for so moving the latter, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, and clutch means and operating connections between the upper slide and the initial driven element, whereby the upper slide may be traversed radially of the upper carriage axis in any angular relation thereto, independently of the lower slide.

9. A compound slide rest attachment for lathes, comprising, in combination, a lower carriage, clamping means for securing said carriage on a lathe bed in variable position along it, said means including spaced depending members on said carriage relatively variably positionable crosswise of a lathe bed for clamping engagement with opposite side portions of such beds of different widths, a drive shaft on and extending lengthwise the lathe bed, an initial driven element on the slide rest, gearing connecting said driven element and the drive shaft in any position of the slide rest along the lathe bed, a lower slide movable on the lower carriage crosswise the lathe bed, clutch-controlled gearing between the initial driven element and the lower slide for so moving the latter, an upper unit including a carriage and a slide movable thereon, said upper unit supported on the lower slide for angular adjustment relative to it about a vertical axis and universally through a full 360° of arc, and clutch means and operating connections between the upper slide and the initial driven element, together with manual operating means associated with said connections, whereby the upper slide may be traversed radially of the upper carriage axis manually or automatically, and either with the lower slide at rest or simultaneously with movement of the latter.

ERNEST R. FIORELLI.