

March 25, 1952

E. J. OSTERHUS

2,590,119

POWER-OPERATED RADIAL SAWING MACHINE

Filed Feb. 9, 1948

11 Sheets-Sheet 1

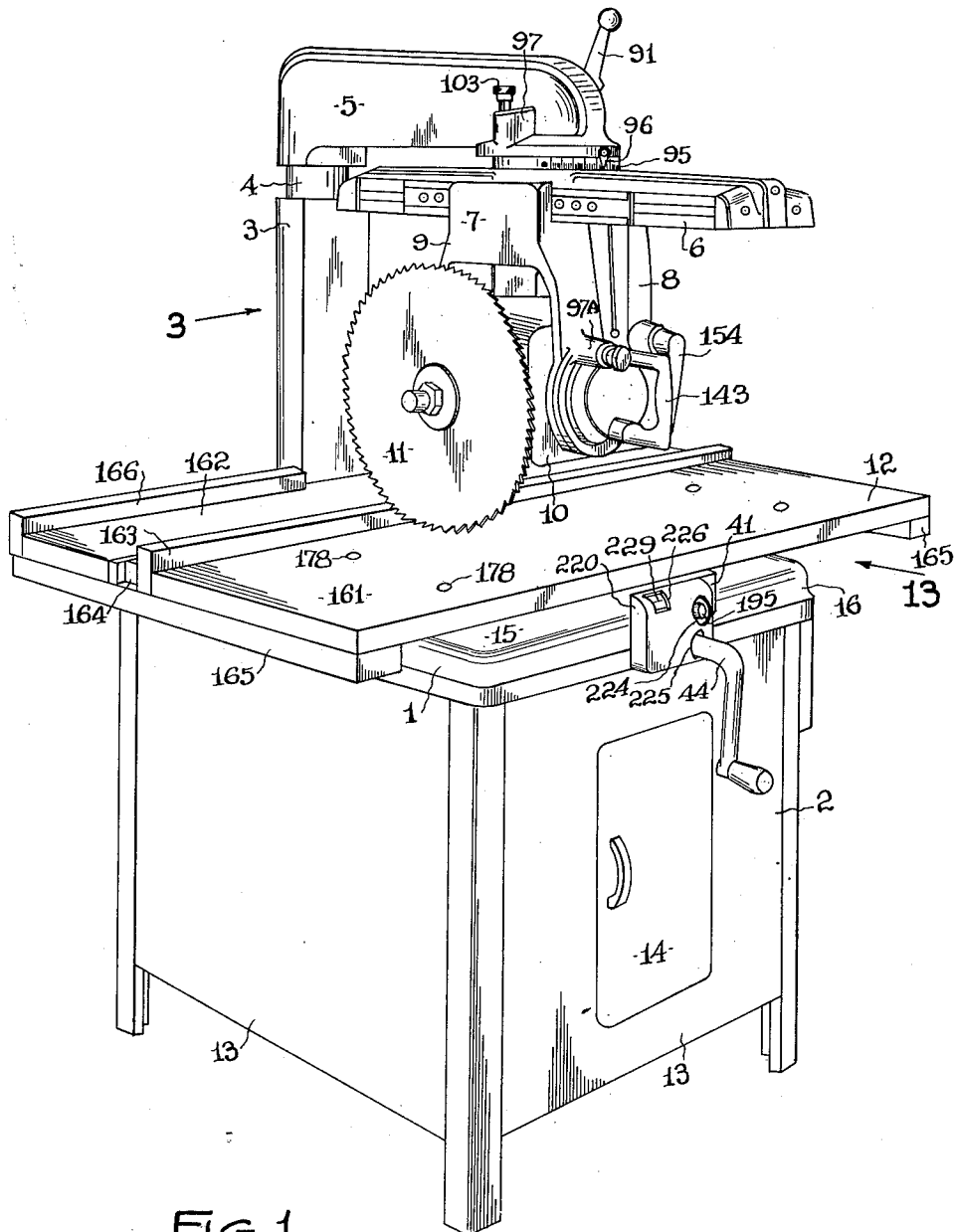


FIG. 1

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11 Sheets-Sheet 2

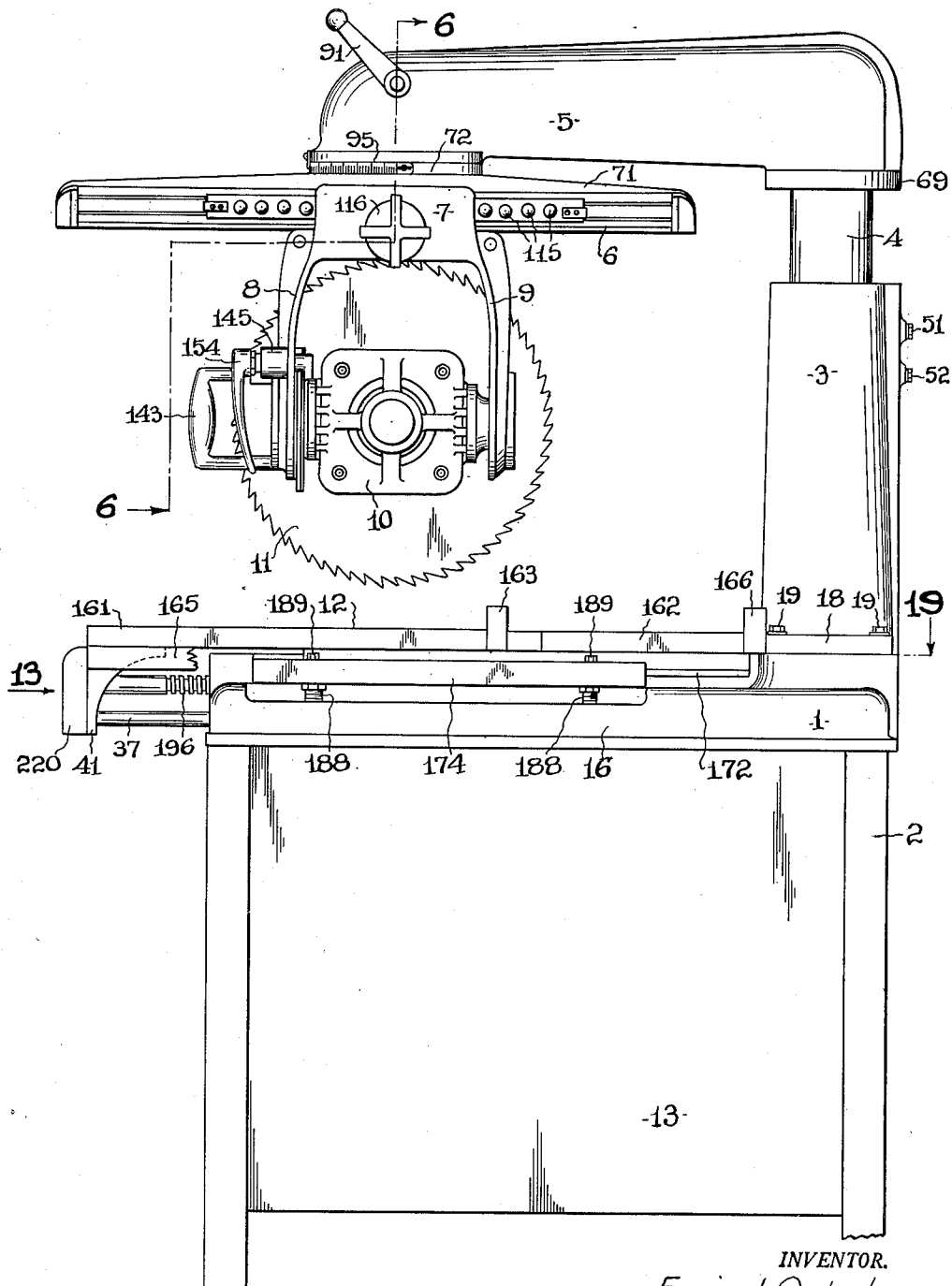


FIG. 2

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11 Sheets-Sheet 3

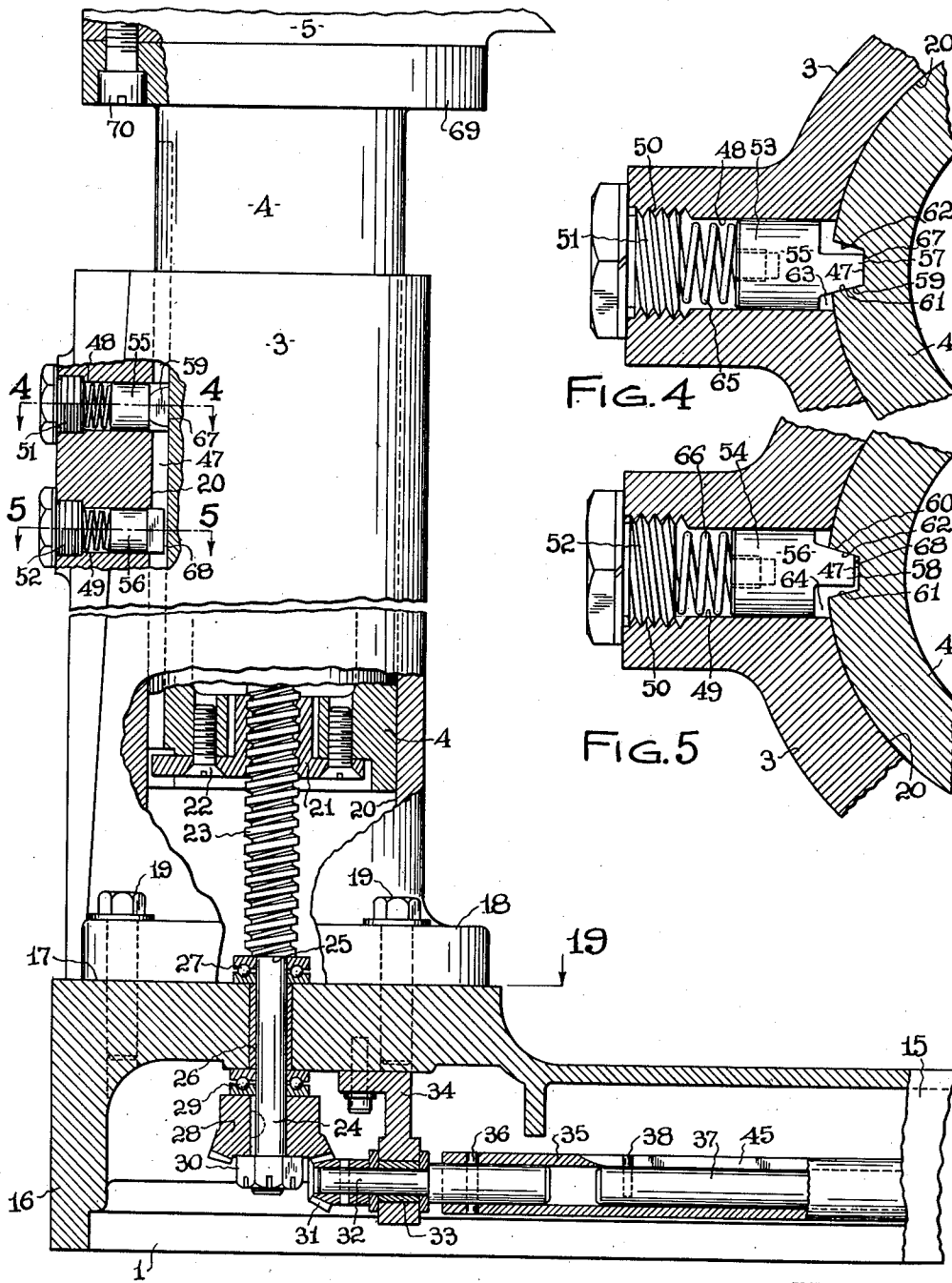


FIG. 3

FIG. 4

FIG. 5

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FIG. 6

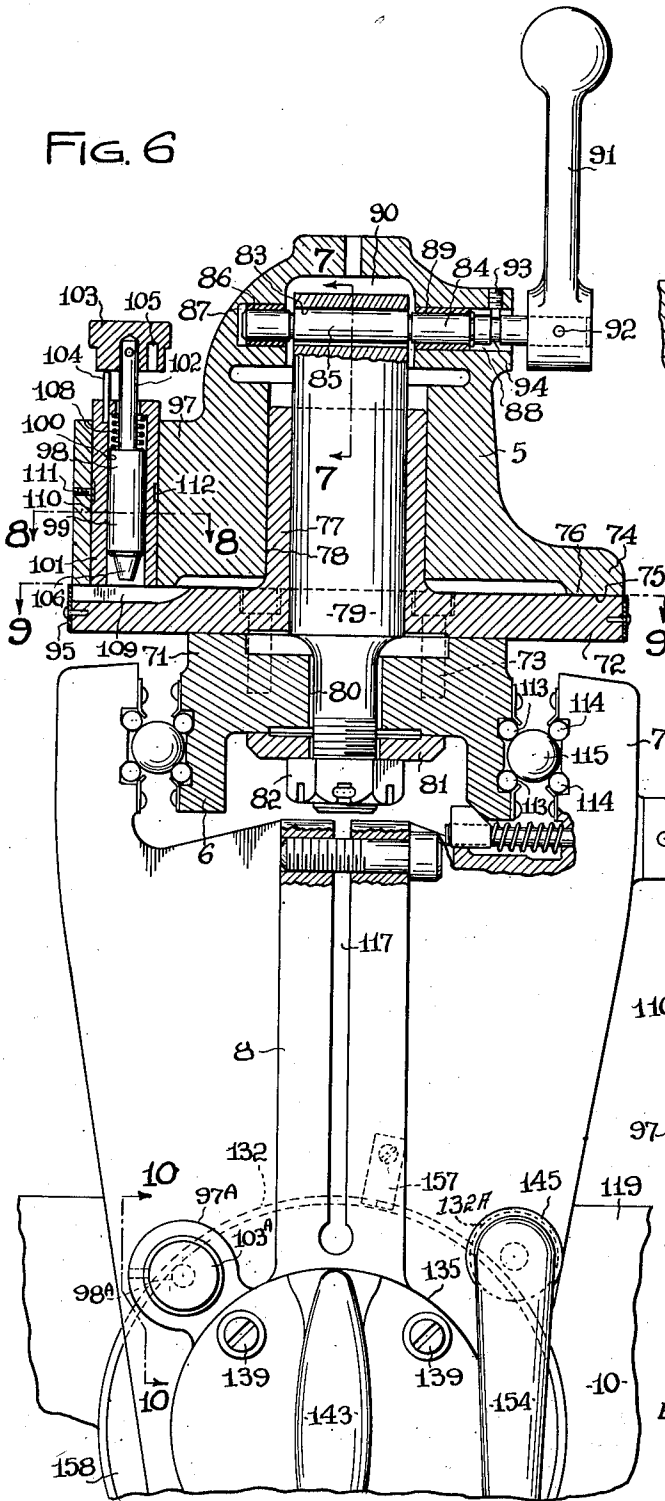
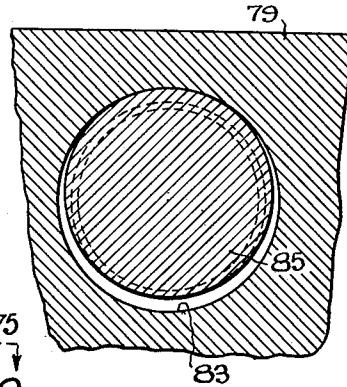


FIG. 7

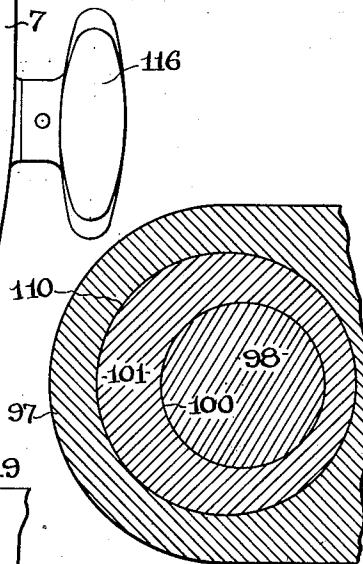


FIG. 8

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11 Sheets-Sheet 5

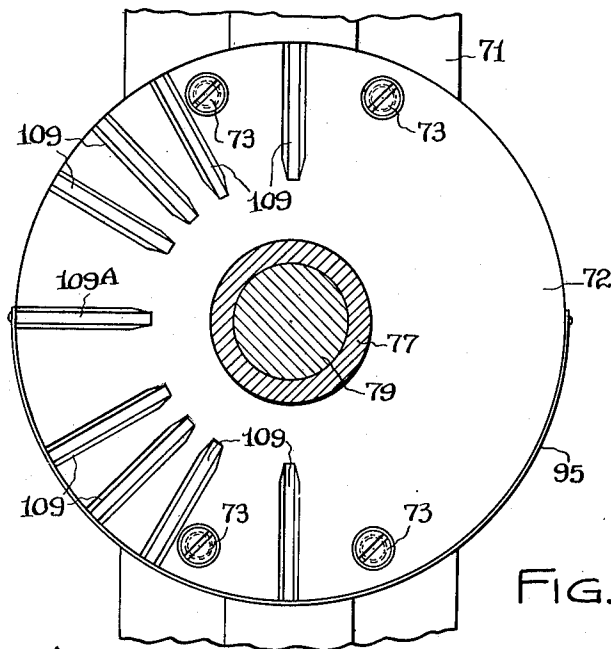


FIG. 9

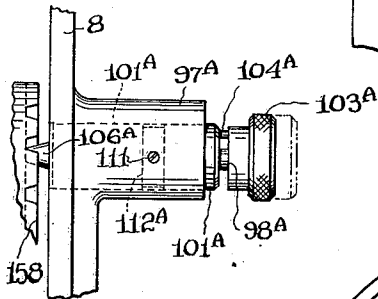


FIG. 10

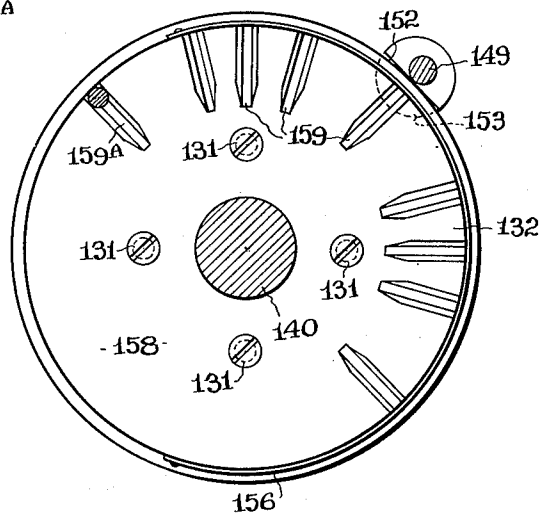


FIG. 12

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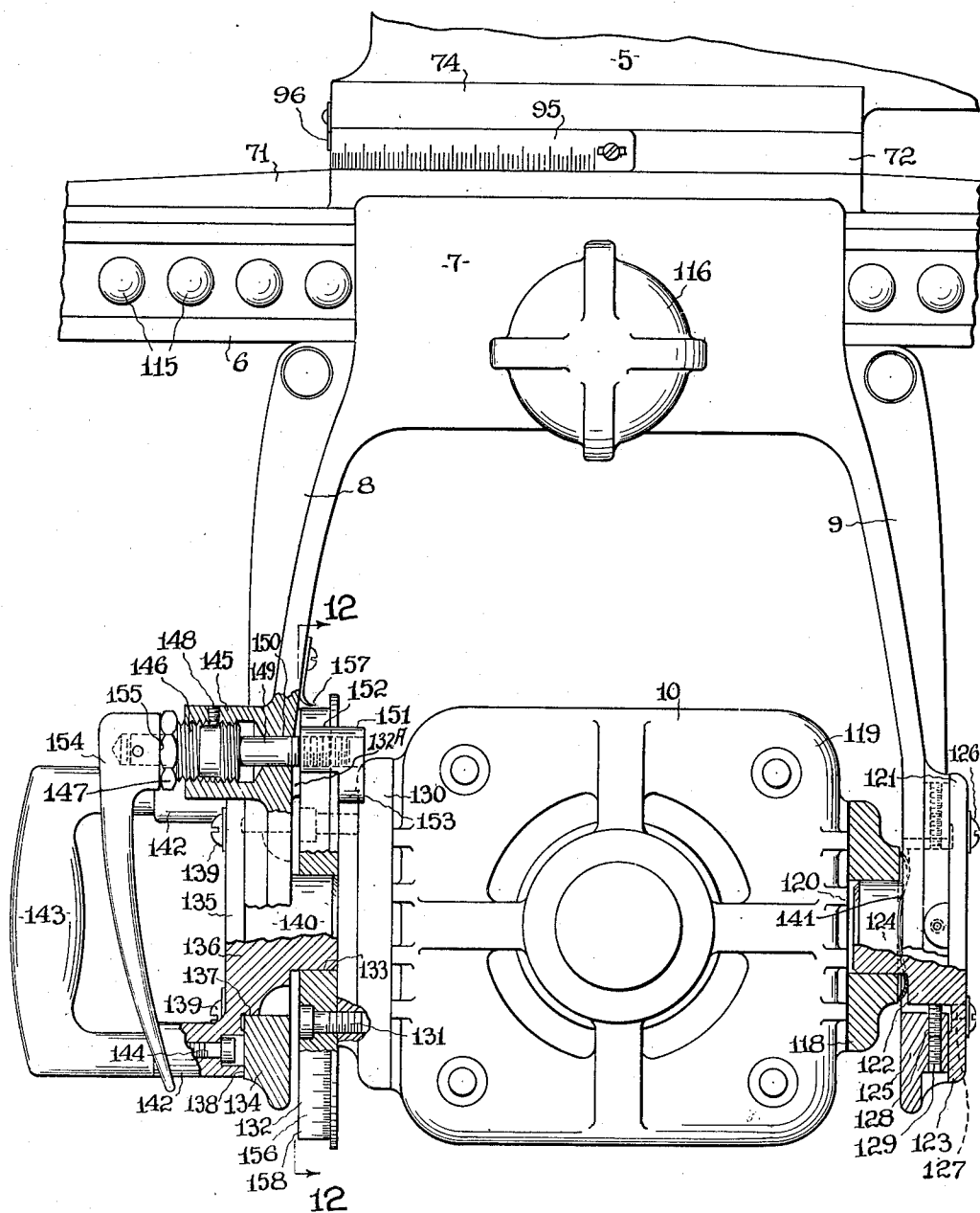


FIG. 11

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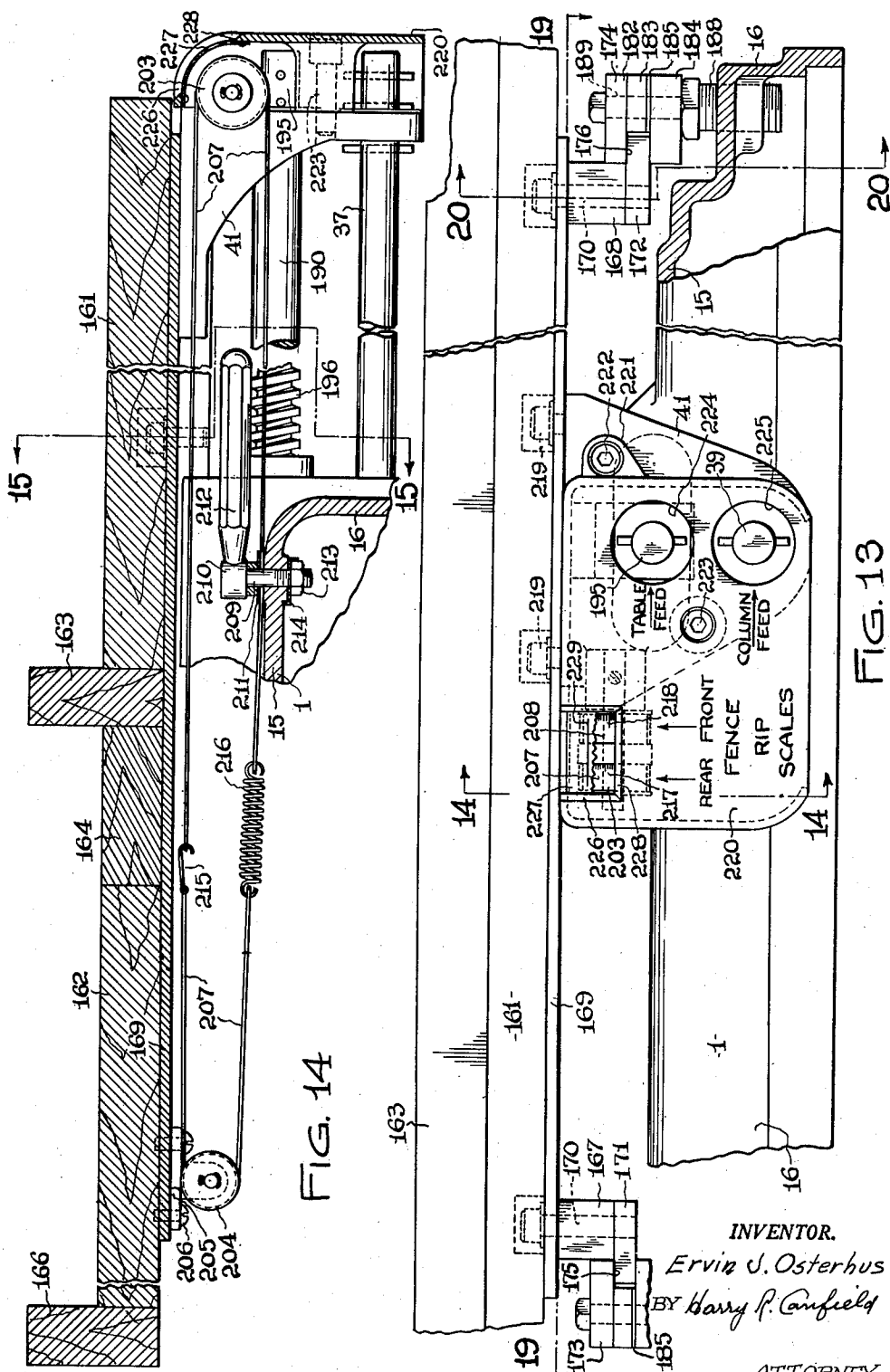
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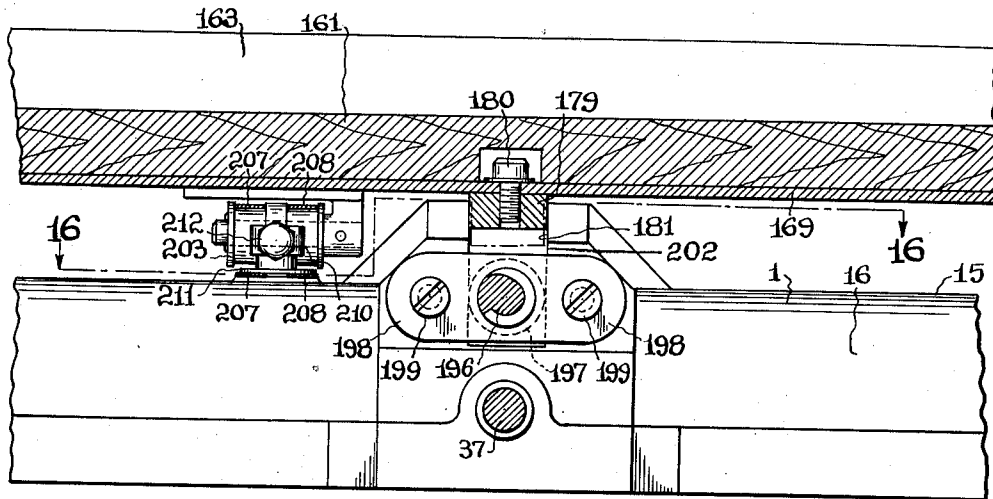


FIG. 15

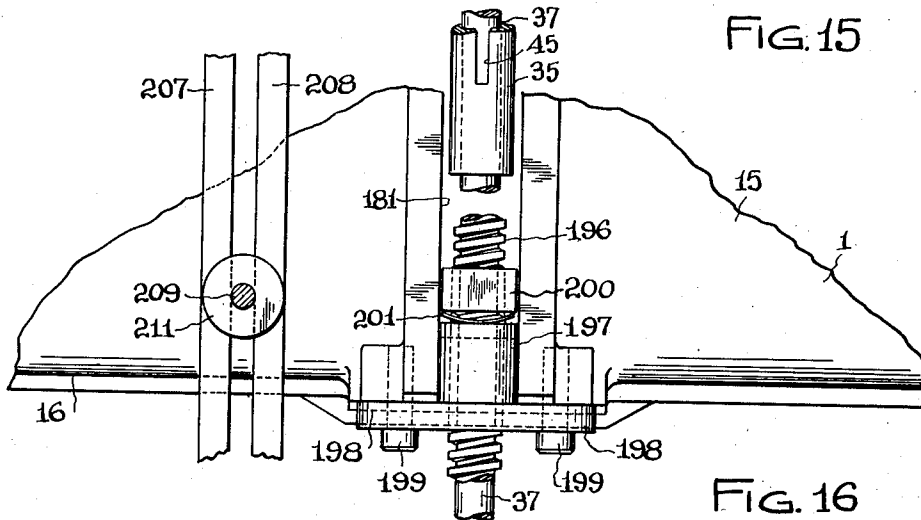


FIG. 16

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11 Sheets-Sheet 9

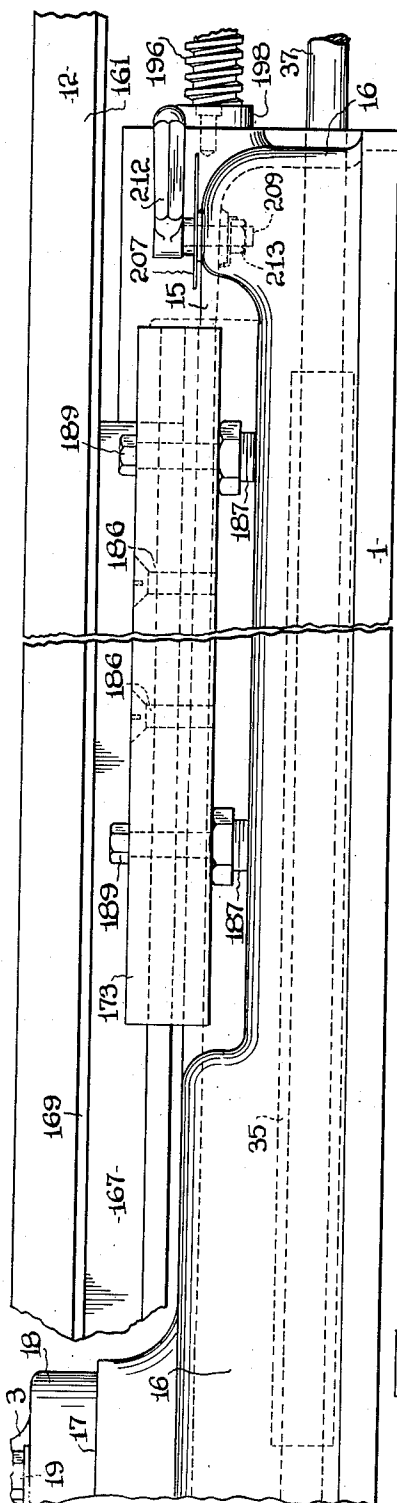


FIG. 17

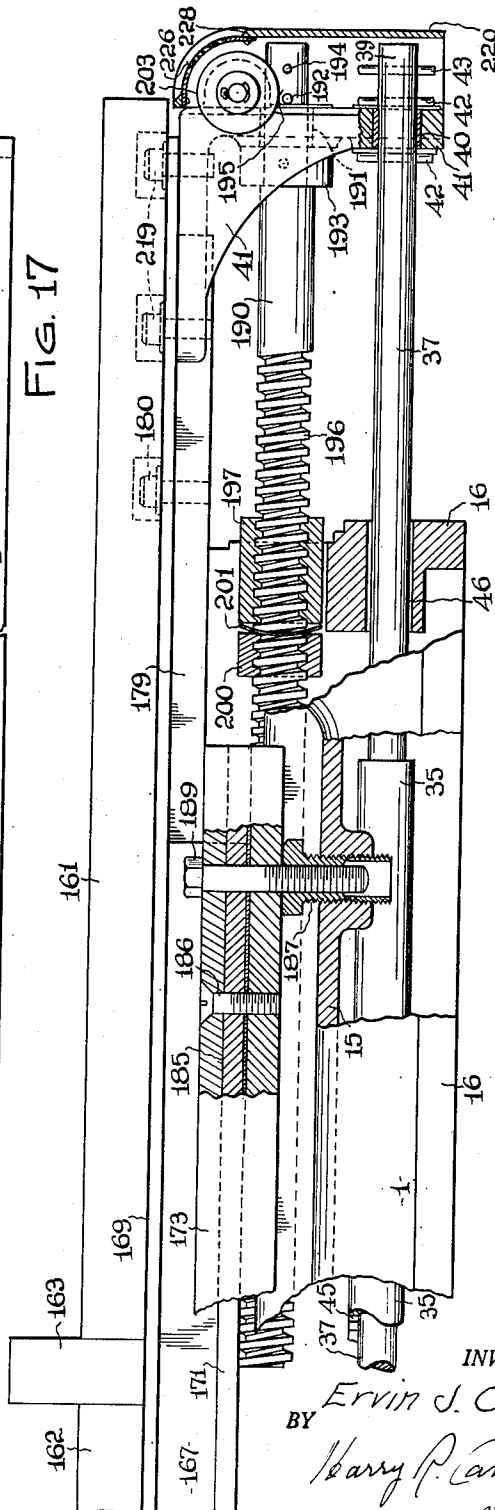


FIG. 18

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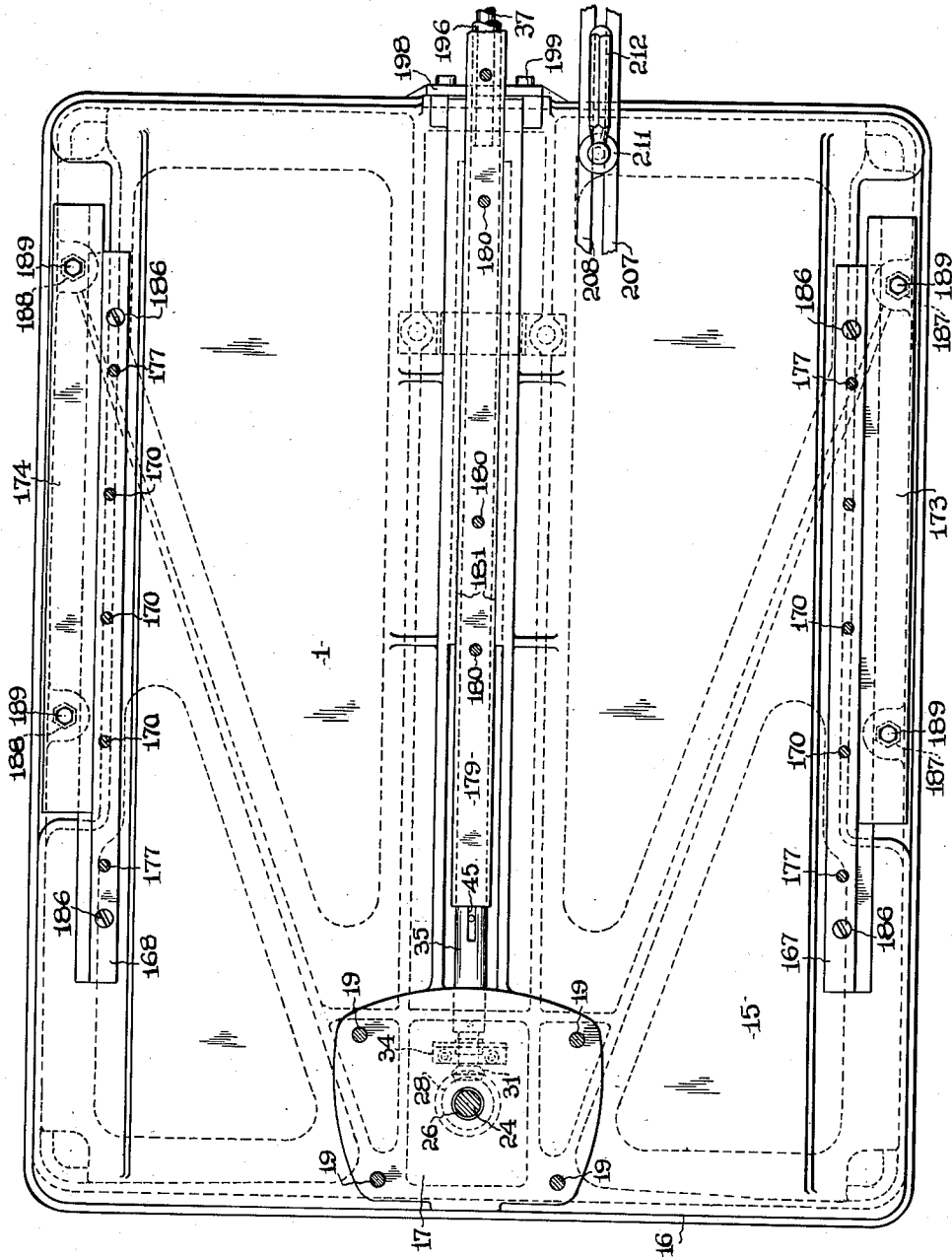


FIG. 19

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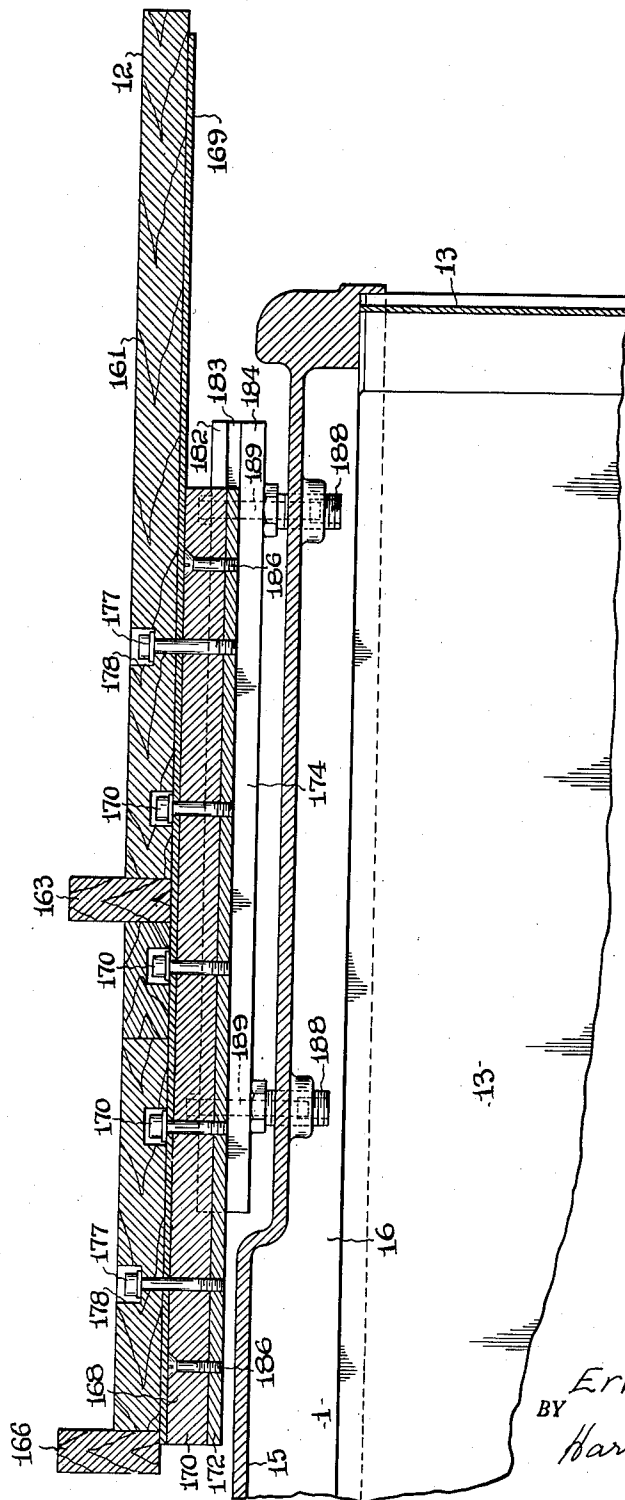
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POWER-OPERATED RADIAL SAWING MACHINE

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UNITED STATES PATENT OFFICE

2,590,119

POWER-OPERATED RADIAL SAWING
MACHINE

Ervin J. Osterhus, Cleveland, Ohio, assignor, by
mesne assignments, of 30/100 to Ralph R.
Roemer, 35/100 to Louise E. Roemer, 25/100 to
William R. Kiefer, and 10/100 to J. Everette
Tompkins, all of Cleveland, Ohio

Application February 9, 1948, Serial No. 7,167

8 Claims. (Cl. 143—6)

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This invention relates to machine tools of the class in which a motor driven saw or like tool is movable by hand over a work supporting table.

In Patents No. 1,956,835, May 1, 1934, and No. 2,343,243, May 7, 1944, are illustrated and described machine tools of this class and the present invention may be considered as constituting improvements over the machine tools of those patents. Furthermore, subject matter illustrated or described herein but not claimed is being claimed in co-pending patent applications Serial No. 641,980, filed January 19, 1946 and Serial No. 715,442, filed December 11, 1946.

In general, in the machines of the above identified patents, there is an arm overhanging a work supporting table; a carriage is reciprocable on a trackway on the arm and supports a motor driven cutting tool, such as a circular wood saw, reciprocable with the carriage; the trackway is pivoted intermediate its ends, to swing to different adjustable directional positions, on a pivot axis on the arm, to position the line of cutting movement of the saw for cross cutting, rip cutting or miter cutting; the motor and the driven saw may be adjustably rocked to different positions to adjustably position the saw for bevel cutting; the arm and the saw carried thereby may be adjustably raised and lowered.

The primary object of the present invention is to provide improvements in various constructional features of a machine of this class, to adapt it to heavier work and greater cutting capacity. The improvements include among others, means: to unlock, position, and lock the pivoted trackway; to support the arm by a stem reciprocable in a column and to automatically take up lost motion between the column and stem while permitting free elevating and lowering adjustments thereof, whereby eliminating the necessity of a lock therefor; to provide an improved horizontally adjustable work table and improved means to level it up to parallelism with the planes of movement of the cutting tool; to provide an improved scale mechanism for indicating at a convenient point on the front of the machine, the adjusted position of the work table; to provide at the front of the machine a readily accessible control panel and controls for adjustably raising the arm and adjustably moving the table; to provide an improved trunnion support upon which the motor and tool may be rocked and locked in adjusted positions.

Other objects will be apparent to those skilled in the art to which the invention appertains.

The invention is fully disclosed in the following

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description taken in connection with the accompanying drawing, in which:

Fig. 1 is a perspective view of a machine embodying my invention showing certain features on the front and on its left side;

Fig. 2 is an elevational view showing certain features on its right side;

Fig. 3 is a fragmentary view to enlarged scale of a part of Fig. 1 viewed in the general direction of the arrow 3 of Fig. 1 with parts broken away and parts in section; showing in section a part of the main base, and showing the arm elevating mechanism, and the automatic take-up for the column and stem;

Figs. 4 and 5 are sectional view to enlarged scale taken from the planes 4—4 and 5—5 respectively of Fig. 3;

Fig. 6 is a sectional view to enlarged scale taken from the plane 6—6 of Fig. 2;

Fig. 7 is a sectional view to magnified scale from the plane 7—7 of Fig. 6;

Fig. 8 is a sectional view to magnified scale from the plane 8—8 of Fig. 6;

Fig. 9 is a sectional view from the plane 9—9 of Fig. 6;

Fig. 10 is a fragmentary elevational view from the plane 10—10 of Fig. 6;

Fig. 11 is a view to enlarged scale of a part of Fig. 2 with parts in section;

Fig. 12 (sheet 5) is a sectional view from the plane 12—12 of Fig. 11;

Fig. 13 is a fragmentary front elevational view to enlarged scale taken in the direction of the arrow 13 of Fig. 2 with parts broken away and parts in section;

Fig. 14 is a sectional view from the plane 14—14 of Fig. 13;

Fig. 15 is a sectional view from the plane 15—15 of Fig. 14;

Fig. 16 is a view from the plane 16—16 of Fig. 15;

Fig. 17 is a fragmentary side elevational view similar to a part of Fig. 2 but to larger scale and rotated through 180° with respect to Fig. 2;

Fig. 18 is a view similar to Fig. 17 but with parts broken away and in section.

Fig. 19 is a view taken from the plane 19 of Figs. 2—3—13 showing the main base of the machine and some of the parts cooperating therewith;

Fig. 20 is a sectional view from the plane 20—20 of Fig. 13.

As shown in the perspective view Fig. 1 and elevational view Fig. 2, the machine tool comprises in general a cast metal main base 1,

mounted on the top of a sheet metal support 2 having the form of a cabinet; a column 3 mounted on the base 1; a stem 4 reciprocable vertically in the column 3; a generally horizontal arm 5 on the stem 4; a trackway 6 adjustably pivotable intermediate its ends about an axis on the arm 5; a carriage 7 operatively reciprocable along the trackway 6; hangers 8 and 9 on the carriage 7, supporting a motor 10; a saw 11 driven by the motor; and a work table 12 supported on the base 1, under the saw 11.

The cabinet form support 2 may be constructed, in any suitable manner, to provide side walls 13—13 whereby it may have an enclosed interior for containing tools, material to be worked, etc. To give access thereto a door 14 may be provided in one or more of the side walls.

The base 1, see Figs. 1, 2, 3, 13, 15 and 19 is preferably a casting, generally in the form of a downwardly open pan, identified in the several figures of the drawing by a pan bottom 15 and circumscribing depending side wall 16. It rests upon and is secured to the top of the cabinet support 2 in any suitable manner.

On the top of the base 1 at the rear end is a pad 17, Fig. 3. As shown in Figs. 2, 3, and 17, the column 3 has at its lower end a flange 18 which rests upon the said pad, and bolts 19 are projected through the flange 18 and screwed into the said base pad to rigidly mount the column on the base. The column 3 is hollow or tubular as shown in Figs. 3, 4, and 5.

The aforesaid stem 4 is hollow or tubular, Figs. 3, 4, and 5, and exteriorly is circular in cross section, and the column 3 has a cylindrical bore 20 therein in which the stem has a sliding fit. The lower end of the tubular stem 4 is closed by a nut 21, Fig. 3, secured thereon by a plurality of screws 22. An elevating screw 23 is meshed with the nut and extends upwardly therethrough into the stem 4, and downwardly therefrom below the nut, and means now to be described is provided to turn the screw to cause it to react upon the base 1 and raise or lower the stem 4 in the column 3, such means being shown best in Fig. 3.

At the lower end of the screw 23 is a reduced diameter screw stem 24 providing a shoulder 25 on the screw. The stem 24 extends through a bearing 26 in the pad 17 of the base 1, and a ball thrust bearing 27 is provided between the shoulder 25 and the top of the pad 17. A bevel gear 28 is keyed to the stem 24, and a thrust ball bearing 29 is provided between the gear and the underside of the pad 17. A nut 30 threaded adjustably on the stem 24 below the gear 28 mounts the aforesaid parts in assembled relation on the base 1, with lost motion in the thrust bearings 27 and 29 reduced to the optimum, and with the screw held against lateral displacement by the stem 24 in the bearing 26, but rotatable by the gear 28, and with the thrust bearings antifrictionally taking up the thrust of the screw 23 and transmitting it to the base 1.

A bevel gear 31 is meshed with the bevel gear 28, keyed or pinned to a shaft 32 rotatably supported in a bearing 33, provided in a bracket 34 secured upon the underside of the base bottom 15.

The shaft 32 extends into a tubular sleeve 35 and is pinned thereto as at 36. The sleeve 35 is telescoped over a rotary shaft 37 and has a longitudinal slot 45 in one side, and a pin 38 in the end of the shaft 37 has longitudinal sliding fit in the slot.

The shaft 37 extends toward the front of the machine and its forward end 39, see Fig. 18, is

rotatively supported in a bearing 40 provided on a bracket 41. This bracket as will be described has forward and rearward movement when the work table 12 is adjusted, and the end portion 33 of the shaft 37 is anchored to it to move with it, by pins or like devices 42—42 projected through the shaft on the front and rear sides of the bracket. A predetermined length of the shaft end 39 thus always projects forwardly from the bracket 41; and is provided with a transverse clutch pin 43 by which a crank 44 as shown in Fig. 1 may be connected to it to rotate it.

The sleeve 35 extends a suitable distance along the shaft 37. The inner ends of the sleeve 35 and shaft 37 telescoped together mutually support each other. The pin 38 in the slot 45 constitutes a driving feather connection by which rotation of the shaft 37 by hand as referred to rotates the gears 31 and 28 and the screw 23 for the purposes described in all forward and rearward positions of the bracket 41.

A clearance bore 46 may be provided in the side wall 16 of the base as shown in Fig. 18 for the shaft 37 to pass through.

In prior machines of this general class having an arm supporting stem that is adjustable vertically on a supporting column, a wedging key and keyway arrangement has been provided to establish accurately a rotated position for the stem on the column; and it has been found necessary to loosen the wedge-key to release the stem for vertical adjustment and then tighten or lock it again accurately to position the stem.

In the present machine, a key and keyway are provided but the necessity of locking and unlocking them and disadvantages thereof have been eliminated.

Referring to Figs. 3, 4, and 5, a longitudinally extending wedge form keyway 47 is provided in the cylindrical wall of the stem 4. Two cylindrical radial bores 48 and 49 are provided in the wall of the column 3, one above the other, the outer ends of the bores being threaded as at 50—50 to receive threaded cap-screws 51—52, and both bores opening symmetrically into the wedge form keyway 47, the axes of the bores preferably intersecting the center line of the keyway, and being radial to the stem 4.

Keys 53—54 are provided in the respective bores 48—49. These keys are preferably alike and have cylindrical bodies 55—56 slidably fitting in the bores 48—49. At their inner ends they have tongues 57—58 projecting into the keyway 47. The tongues 57 and 58 have inclined flat faces 59 and 60 which are each of the same angular inclination to the radius of the bore (48 or 49) as the inclination of the side walls 61 and 62. The bodies 55—56 therefore can be rotated so that when projected inwardly, the inclined face 59 of the tongue 57 will intimately coincide with the wall 61 of the keyway, and the inclined face 60 of the tongue 58 will coincide with the opposite wall 62 of the keyway. Springs 65 and 66 are provided between the cap screws 51—52 and the outer ends of the bodies 55—56 to yieldingly press the bodies 55—56 and tongues 57—58 inwardly as described.

The tongues 57—58 are axially longer than the depth of the keyway 47 so that there is always clearance (at 63—64) between the bodies and the stem 4.

One spring, say the upper spring 65 of Fig. 4, is stronger than the other spring 66, and forces the tongue 57 inwardly until it bottoms on the bottom of the keyway 47 as shown at 67. This

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determines a rotative position for the stem 4, in say the clockwise direction as viewed in Fig. 4. Any force on the stem tending to rotate it clockwise beyond that position is transmitted to the tongue 57, thence through the body 55 to the cylindrical wall of the bore 48 which is on the column 3.

The other spring 66 forces the tongue 58 inwardly as far as it can go, engaging it with the wall 62 of the keyway as described; but the tongues 57 and 58 and their inclined faces 59 and 60 are so disposed on the bodies 55—56 that when the tongue 57 is bottomed in the keyway as referred to, the tongue 58 cannot bottom but always has clearance as at 68. The stem therefore is held in the aforesaid determined position, any force tending to rotate it counter-clockwise being transmitted to the tongue 58, thence through the body 56 to the cylindrical wall of the bore 49.

Since the tongue 58 never bottoms, it always is resiliently pressed into the keyway and takes up all lost motion, at both sides of the keyway and at both cylindrical bores, and continues to do so as wear occurs.

The stem is thus rigidly locked against rotation in either direction, and at the same time the pressure at the keyway walls 61 and 62 is not so great but what the stem can be slid up and down in the column by the application of practically small force by the screw 23.

The arm 5 shown in Figs. 1, 2, 3, and 6, is preferably an internally ribbed, downwardly open casting of any suitable design; and at its rearward end rests upon an externally projecting flange 69 on the top of the stem 4, and secured thereto by a plurality of screws 70, one of which is shown in Fig. 3, projected upwardly through the flange 69 and threaded into the arm 5. This rigidly joins the arm 5 to the stem 4 as a single unit, whereby the arm 5 may be raised and lowered by the screw 23.

The horizontal trackway 6 (upon which the motor supporting carriage 7 reciprocates) is supported under the forward end of the arm 5 to rotate on a vertical bearing axis and to be locked in any angular rotated position, see Figs. 1, 2, 6, and 9.

The trackway 6 comprises an elongated body 71 in the form of a casting, upon the upper side of which and at its middle is secured a circular disc 72 by screws 73 (Figures 6 and 9) projected downwardly through holes in the disc and threaded into the body 71.

The disc 72 at its center has an upwardly extending tubular integral sleeve 77, the outer surface of which is cylindrical and has rotational bearing in a vertical downwardly open bore 78 in the arm 5.

The arm 5 at its forward end and on its underside has a generally horizontal flange 74 the underside of which is formed to have a horizontal annular face 75 thereon, coaxial with the bearing bore 78. By operable means to be described the trackway 71 is suspended from the arm 5 and can be rotated, the sleeve 77 rotating in the bore 78, and can be raised, the sleeve 77 moving axially in the bore 78, to clamp the upper face 76 of the disc against the said annular face 75 to lock the two together to prevent rotation of the trackway.

Said operable means comprises a spindle 79 reciprocable in the tubular sleeve 77. At its lower end it projects through a clearance hole 80 at the center of the trackway body 71 and below it passes through a disc 81 and therebeyond is threaded into a castellated nut 82 by which it

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can be adjusted along the threads and locked when adjusted.

At its upper end, the spindle 79 projects beyond the sleeve 77 and into a recess 90 in the arm 5; and the spindle has a transverse cylindrical bearing bore 83 (see Figs. 6 and 7) therethrough, through which extends a cam shaft 84 having a cylindrical eccentric cam 85 thereon in the bore. The cam shaft 84 has bearing at one end at 86 in a recess 87 of the arm 5 axially beyond the bearing bore 83; and at the other end extends outwardly through and beyond a bore 88 in the arm, and has bearing at 89 in the bore 88.

An operator's handle 91 is pinned as at 92 to the cam shaft 84. End shifting of the cam shaft is prevented by a screw 93 projecting into a groove 94 in the shaft.

Upon turning the cam shaft 84 back and forth by means of the handle 91, the cam 85 reacting on the wall of the bore 83 reciprocates the spindle 79.

When the handle 91 is rotated away from the observer as viewed in Figs. 1 and 6 or to the right as in Fig. 2, the cam 85 reacting on the bore 83 raises the spindle 79 and the nut 82 thereon raises the washer 81 and through it raises the trackway body 71 and disc 72 and frictionally engages the disc face 76 with the annular face 75 on the arm 5 and locks the trackway against rotation. By suitably adjusting the nut 82, the parts will come tight in the convenient position of the handle 91 illustrated.

Upon turning the handle 91 in the reverse direction, the spindle 79 is lowered, releasing the described frictional engagement lock. The trackway may then be turned by hand to the desired angular position, being supported by the washer 81, spindle 79, and cam shaft 84; and the disc 72 rotating with it. The spindle is held against rotation by the cam shaft 84 extending transversely through it.

To accurately indicate the rotated position of the trackway, a sheet metal band scale 95 is mounted on the periphery of the rotatable disc 72 and a scale indicating pointer 96 is mounted on the stationary flange 74.

To conveniently set the trackway at the frequently used angular positions, namely at cross cutting position; rip cutting at 90° on either side of the cross cutting position; miter cutting at 30°, 45°, 60°, on either side of cross cutting; indexing means is provided.

At one side of the arm 5, opposite the axis of the spindle 79 is a lateral arm extension 97 in which is housed above the disc 72, a vertically reciprocable indexing pin 98, comprising an elongated cylindrical body 99 reciprocable in a bore 100 in a sleeve 101.

A stem 102 on the upper end of the pin terminates in a handle 103 to manually retract the pin, and a stationary pin 104 engages the underside of the handle to hold it retracted, and the handle has a hole 105 into which, upon rotating the handle, the pin 104 may project to allow the pin 98 to descend. The lower end 106 of the pin is wedge-shaped or conical.

A spring 108 is provided resiliently urging the pin 98 downwardly at all times.

In the upper surface of the disc 72 radial grooves 109—109 are formed, see Fig. 9, corresponding to the above indicated desired angular positions, and wedge shaped to correspond to the shape of the pin end 106, and into which the pin end 106 may be projected by the spring 108.

The grooves 109—109, four of which are shown

on each side of the cross cut positioning groove 109A, can be accurately spaced the correct angular distances apart by indexing devices on the milling or other machine used to cut them. Also, the trackway can be angularly and accurately adjusted until the saw 11 is in position to cut 90° cross cuts. If the pin end 105 then accurately fits the groove 109A, the trackway can thereafter accurately be set at all angles by the indexing pin. To thus bring the indexing pin into accurate fit with the groove 109A its reciprocatory axis is made laterally adjustable. To this end, the exterior surface of the sleeve 101 is cylindrical but eccentric with respect to the axis of the pin bore 100 in it; and is mounted rotatably in a cylindrical bore 110. By manually rotating the sleeve 101 the axis of the pin 98 will be shifted circumferentially of the disc 72 to position the pin 98 to fit the groove 109A as aforesaid. The sleeve may then be locked in its adjusted position by a screw 111. The radial shifting of the pin 98 incidental to this adjustment does not detract from accuracy because the pin end 105 will fit the grooves in the same way at all radial distances along the groove.

The trackway 6 and the carriage 7 that reciprocates along it, have mutually cooperating anti-friction bearings comprising round rod raceways 113 on the trackway 6, and 114 on the carriage 7 (Fig. 6) and balls 115 therebetween; and a lock operable by rotation of a handle 116 is provided to lock the carriage 7 in any reciprocated position; and slots 117 in the hangers 8 and 9 (shown for the hanger 8 in Fig. 6) are provided to take lost motion or excess clearance in said ball bearings; but these features not being a part of the present invention need not be further described.

At the lower ends of the hangers 8 and 9 are trunnion bearing supports for the motor 10 which will now be described.

A bearing plate 118 (Figure 11) is secured rigidly upon the side of the motor housing 119 and has a cylindrical bearing bore 120 therein. A trunnion element 121 is provided comprising a central cylindrical body 122, an enlarged diameter flange 123 at one axial end, and a reduced diameter trunnion 124 at the other axial end, the latter projected into the bearing bore 120.

The lower end of the hanger 9 terminates in a ring 125 surrounding the body 122 with clearance. The flange 123 overlaps the ring 125 and is secured thereto by screws 126 going through over-sized holes 127 in the flange and threaded into the ring 125.

The trunnion 124 is thus mounted on the hanger and the motor has bearing on the trunnion.

Adjustment is provided to adjust the special position of the motor axis for well known purposes in saws of this class, by adjusting the trunnion axis with respect to the hanger 9. A plurality such as four screws 128 are threaded radially through the hanger ring 125 and engage the cylindrical body 122. By backing one or more out a turn or more and screwing another in, the body 122 may be shifted in any direction radially within the ring 125. The screws 128 may be locked in place by other screws 129 screwed in on top of them.

Before making this adjustment, the screws 126 may be temporarily loosened to allow the flange 123 to slide on the ring 125, while the adjusting is going on, as will be understood.

As also shown in Fig. 11, and at the opposite

side of the motor 10, a trunnion bearing plate 130 is secured upon the motor housing 119, and rigidly mounted thereon by screws 131, see also Fig. 12, is an indexing plate 132 having a central trunnion bearing bore 133 axially aligned with the bore 120 in the opposite plate 118.

The lower end of the hanger 8 terminates in a ring 134. A trunnion element 135 comprising a central body 136, is centered in the ring 134 by annular shoulders 137—138 and secured to the ring by screws 139—139; and comprising a trunnion 140 fitting the trunnion bore 133.

The plate 130 abuts upon the inner end of the trunnion 140; and it is held in abutment thereon with to eliminate lost motion axially at both trunnions 140 and 124 by a sheet metal spring 141 associated with the trunnion 124; the spring being in the form of a washer surrounding the trunnion 124 and disposed between the plate 118 and the body 122; and being dishd out of a plane so as to react upon the body 122 and exert resilient thrust axially upon the plate 118.

The trunnion element 135 also comprises posts 142—142 upon which a U-shaped handle 143 is mounted by screws one of which is shown at 144.

From the foregoing, it will be seen that the motor 10 and the saw 11 driven thereby supported by the carriage hangers 8—9, may be rocked to various angular positions on the hangers, on the axis of the trunnions 140—124, for bevel cuts; and means is provided to lock them at said angles and to indicate said angles.

The hanger 8, see Figs. 6, 11, and 12, has an interiorly threaded boss 145 thereon in which is adjustably screwed a stop element 146 having externally of the boss 145 a hex head 147 for adjustably turning it, and having a set screw 148 for engaging it to lock it against turning after adjustment.

A shaft 149 has rotary bearing in the stop element 146 and in an aligned bore 150 in the hanger 8. The shaft extends beyond the hanger 8, and is screwed into a head 151 having a portion 152 overlapping the disc 132 and adjacent to its periphery which prevents rotation of the head, and having a lip 153 extending inwardly radially of the disc 132 on the face thereof toward the plate 130.

The opposite end of the shaft 149 projects out of the stop element 146 and has pinned thereto a handle 154 for turning the shaft; a face 155 on the handle confronting the said hex head 147.

Upon clockwise rotation of the shaft 149 by the handle 154, the shaft will be screwed into the head 151, the face 155 on the handle will engage the hex head 147, the head 151 will be propelled inwardly on the shaft 149, and the lip 153 will be drawn into engagement with the disc 132, and hold the plate 130 upon the end of the trunnion 140, thereby developing frictional gripping engagement between the lip 153 and the disc 132 locking the latter against rotation.

The handle 154 will come tight and rotation thereof will be stopped by frictional reaction engagement of the handle face 155 with the hex head 147. Further friction may be provided by engagement of the disc 132 with a circular pad 132A on the hanger 8 opposite the lip 153.

To cause the handle to then be in a convenient rotated position, for example that of Figs. 1, 2, 6, and 11, the stop element 146 can be adjustably rotated in one direction or the other until the handle does come tight in the desired position.

A band scale 156, Figs. 11 and 12, fastened to the periphery of the disc 132, and a scale pointer

157, Figs. 11 and 6, therefor fastened to the hanger 8, indicate angular positions of the disc 132. The motor 10 and saw 11 may thus be set at any angular position of the saw with respect to the work table for so-called "bevel" cutting.

To conveniently set the motor and saw at the more frequently used angular positions, namely the angles 90°, 60°, 45°, 30°, and 0°, indexing means is provided.

On the hanger 8, projecting forwardly therefrom, is an extension 97A, Figs. 1, 6, and 10, in which is reciprocable an indexing pin 98A having a conical or wedge-form end 106A. The extension 97A is so located that the face 158 of the disc 132 that confronts the hanger 8, overlaps the end 106A of the pin as indicated in Fig. 6; see also Fig. 10. That face 158 of the disc 132 is provided with wedge-form grooves 159—159, Fig. 12, into which the end 106A of the pin may be projected to lock the disc against rotation, the grooves being disposed to position the disc rotatively at said desired angular positions.

The construction of the pin 98A and its associated parts in the extension 97A, may all be identical with the parts in the extension 97 of Fig. 6, including the eccentric adjustment of the pin; and this is indicated by giving to the visible parts of Fig. 10 the same reference characters as in Fig. 6, but with the suffix A; to make unnecessary a detailed description thereof.

As was the case with the grooves 109 in the disc 72 of Fig. 9, the grooves 159 in the disc 132 of Fig. 12 may be accurately spaced apart in the disc when cut. The motor 10 (and disc 132) may be rocked on the hangers 8—9 to position the saw 11 at right angles to the work table 12 under it; and the pin 98A may be adjusted eccentrically (as described for the pin 98 of Fig. 6) to cause the pin end 106A to then accurately fit in the 90° groove 159A of the disc 132, Fig. 12. The pin 98A and grooves 159 will then index the disc 132 accurately at the other angles.

The work table 12 is preferably constructed from wood, and comprises a table top proper 160, in two parts 161—162, Figs. 1, 2, and 14, having a fence 163 removably secured therebetween in a well known manner by wedges, one of which is shown at 164, Fig. 1, and being fastened together by underside cleats 165, Fig. 1, and one of which is shown broken off in Fig. 2. A rear fence 166 is also provided, secured permanently to the rear edge of the top part 162.

The table 12 is reciprocable forwardly and rearwardly, by a manually operable feed, to generally adjust it to the working zone of the saw 11 in various positions of the latter; but particularly to position the fences 163 and 166, respectively, desired distances from the saw 11 when set for narrow and wide rip cuts; and scales are provided to indicate the positions of the fences, respectively, from the saw to indicate the width of the rip cut. These and other features of the work table will now be described in connection with Figs. 1, 2, 19, and 20.

Looking toward the front edge of the table, Fig. 13, there is shown at 167—168 the forward ends of a pair of transversely spaced steel rails secured to the underside of a steel plate 169 by screws 170—170. The transverse width of the plate 169 is indicated in Fig. 13 and its length (forward and rearward) in Figs. 14 and 20. The plate 169 is rectangular and together with the rails on its underside (which incidentally reinforce it) constitutes a secondary base as a unit.

The rails 167—168 are L-shaped transversely

as shown in Fig. 13, to provide laterally extending tongues 171—172; and to this end may conveniently be made of two pieces held together by the screws 170. The tongues 171—172 slide in spaced longitudinal guideways 173—174, having laterally open grooves 175—176 therein best shown in Fig. 13 to slidably receive the tongues.

The table proper 161—162 is mounted on the plate 169 and on the rails 167—168 by screws 177—177, see Fig. 20, the heads of the screws being seated in counter-bored holes 178 in the table, see also Fig. 1, whereby the table top can be detached and renewed without disturbing the unitary assembly of the plate 169 and rails 167—168. The engagement of the tongues 171—172 with the lower side of the grooves 175—176 supports the weight of the table on the underside of the tongues for reciprocatory movement, and the engagement of the tongues with the upper sides of the grooves prevents the table from being lifted with respect to the guideways 173—174. It is for these reasons that the guideways grooves are made, as referred to, laterally open, and the tongues are made laterally projecting.

Guiding of the table to reciprocate accurately along a longitudinal directional line is provided for by a gib 179, Figs. 15, 18, and 19, secured to the underside of the plate 169 by screws 180 projected through the plate and screwed into the gib; and guided longitudinally in a longitudinal guideway 181 in the upper side of the base 1.

The tongues 171—172 therefore need not accurately bottom in the grooves 175—176, which makes for economy in manufacture; and the grooves may be adjusted to fit with the top and bottom of the tongues for purposes referred to, by making the guides 173 and 174 of upper, lower and intermediate pieces 182—183—184 (see right hand side of Fig. 13) with a shim 185 between the pieces 183—184, the parts being held together in a unitary guide by longitudinally spaced screws 186, see Figs. 17 and 18.

It is desirable to be able to "level up" the table, or, adjust the plane of its top to be parallel to the plane of movement of the saw. This is done by levelling up the guides 173—174 relative to the base 1 as follows.

Each of the guideways 173—174 rests upon the upper ends of two large diameter longitudinally spaced adjusting screws 187—187 and 188—188, screwed into the base 1, Figs. 17, 18, 19, 20, and 13, and having hex heads as shown. Screws 189 are projected downwardly through the guides, and threaded axially into the screws 187—188 and hold the guideways tightly on the adjusting screws. By loosening a screw 189 the corresponding adjusting screw can be rotated by its hex head with a wrench to raise or lower the hex head to raise or lower that end of the guideway. When the screw 189 is again tightened, it locks the adjusting screw against turning, by clamping the guideway rigidly between the hex head and the head of the screw 189. The screws 189 preferably have hex heads for turning whereby they are operable from the side and under the table.

The table is reciprocable longitudinally as referred to, as follows.

A propelling screw 190, Figs. 13, 14, and 18, extends longitudinally under the table, and at its forward end has rotary bearing at 191 in the aforesaid bracket 41, being held against shifting axially by a pin 192 and a pinned washer 193 on the other side of the bracket; and having a pin 194 in its forward end portion 195 whereby the

handle 44 (see also Fig. 1) may be clutched to it for rotating it.

The rearwardly extending portion of the screw 190 is threaded as at 196; and as best shown in Figs. 16, 15, and 18 is threaded through a nut 197 secured upon the forward part of the base 1; and to this end, the nut 197 has opposite wings 198—198 (Figs. 15 and 16) attached to the base by screws 199; whereby when the screw 196 is rotated the table is propelled.

It may be desirable for the screw to fit loosely in the nut 197, to allow for some rise and fall of the forward end of the screw as the table is adjustably raised and lowered to level it up as described. To take up endwise lost motion in the nut 197 that might result from this, a supplemental nut 200, Figs. 16 and 18, is threaded on the screw 196 spaced longitudinally from the nut 197 and an annular dished sheet metal spring 201 surrounds the screw between the nuts and reacts oppositely axially on them, thus taking up the lost motion. The nut 200 is prevented from turning by extending upwardly as at 202, Fig. 15, into the guideway 131 on the base. The nut 197 is by this means also frictionally engaged with the screw 196 so as to hold the screw in adjusted rotated positions.

The table can be adjusted longitudinally in the above described manner to position the fences 163—166 to bring work being positioned by the fences into a convenient position relative to the working zone of the reciprocable saw. Either of the fences 163 and 166 may be used alone, (the rearward fence 166 after the forward fence 163 has been removed upon removing the wedges 164). When the fences are used for some operations, particularly for positioning the work for making rip-cuts parallel to the fences, it is desirable to accurately gage the distance between them and the saw blade and this is done by an indicating scale as follows.

A drum 203 (Figs. 13, 14, and 15) is rotatably mounted on the bracket 41 at the forward part of the table; and aligned therewith radially is a drum 204 (Fig. 14) rotatably supported by a bearing support 205 fastened by screws 206 to the plate 169. A pair of ribbons or tapes 207 and 208 of flexible sheet metal, side by side are looped over the drums in the nature of belts on pulleys. At a point on the ribbons between the drums, they are longitudinally adjustably secured to the base 1 (Figs. 14, 16, and 19). The securing means comprises a shaft 209 extending downwardly through a bore in the top of the base 1, a head 210 on the upper end of the shaft, a washer 211 between the head 210 and the base, a horizontal handle 212 on the head, a nut 213 threaded on the shaft 209 below the base and a lock washer 214 to lock it against rotation.

The ribbons 207—208 are on opposite sides of the shaft 209 and between the washer 211 and the base, and the washer 211 overlaps both ribbons. Upon turning the shaft 209 by the handle 212, the washer 211 will clamp the ribbons upon the base 1 and secure them against longitudinal shifting.

Each ribbon may be made of two pieces joined at their ends as at 215, Fig. 14, by any suitable readily detachable hook or the like fastener, and preferably their other ends are connected by a spring as at 216, which is stretched and maintains a suitable longitudinal tension in the ribbon.

From this description, it will be apparent that as the table is reciprocated longitudinally as de-

scribed carrying the drums 203—204 with it, the ribbons will run over the drums in the nature of a belt and belt pulleys. (This is rendered more readily apparent if it be considered that the table is at rest and the base 1 with the ribbons attached to it is the part that moves longitudinally, the relative motion being the same in both cases).

Each ribbon has a scale thereon as shown at 10 217 and 218, Fig. 13, in that portion of the ribbon that loops over the forward drum 203, and visible from the front of the machine.

A stationary scale pointer to be described co-operates with the scales.

15 The scales are in inches and fractions of an inch, and are adjusted to indicate respectively the aforesaid positions of the respective fences, by putting the fence in contact with the saw blade, and then adjusting the corresponding ribbon longitudinally until its scale indicates 20 zero.

This adjusting of the ribbon is effected by turning the handle 212 to relieve the clamping force of the washer 211 on the ribbon, and then 25 adjustably sliding the ribbon along under the washer and over the drum, to the desired indicating position and then turning the handle 212 to again clamp and secure the ribbon.

Referring again to the bracket 41, it is secured 30 to the plate 169 on the underside of the table at the front thereof (Figs. 2, 13, 14, and 18) by screws 219. As described, it rotatably supports, and longitudinally anchors the screw 190 and shaft 37 which have end portions thereof 195 and 35 39 projecting forwardly for engagement by a handle 44. The forward scale drum 203 is also as described mounted on the bracket. As shown in Fig. 13, these operative parts are all closely adjacent to each other on the bracket 41; and as 40 shown best in Fig. 13 an ornamental cover is provided therefor, in the nature of a control panel 220.

The panel 220 is secured to the bracket 21 by an ear 221 through which a screw 222 is projected and screwed into the bracket; and by a 45 screw 223 passing through the front wall of the panel and screwed into the bracket 41 (see Fig. 14).

The panel 220, preferably a casting, has openings 224—225 coaxial with and larger than the said end portions 39 and 195 of the said shaft and screw, and the end portions do not protrude from the openings, and the openings are large enough to receive the clutch end of the handle 50 44 as indicated in Fig. 1; which adds to the appearance of the control panel.

The panel has a window 226 closed by a window-pane 227 of any suitable transparent plastic material, opposite the drum 203, through which 60 it may be viewed. The lower side of the window is bevelled and the edge as at 228 may be used as the scale pointer or indicator referred to above. But I prefer to provide an index line or pointer line 229, Fig. 1, on the window-pane as the scale pointer or indicator.

As customary with control panels, generally, legends may be provided on the control panel 220 to identify the table adjusting screw as at 195 and the column elevating shaft as at 39; and to 70 identify the ribbon scales 207 and 208 as indicating the position of the respective fences for rip-cuts.

The invention may be embodied in other specific forms without departing from the spirit 75 or essential characteristics thereof. The present

embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a machine tool of the type comprising a main base and a tubular column rising from the base and a stem guided for vertical movement within the column to adjust the elevation of a tool supported by the column, and means to adjustably reciprocate the stem in the column; improved means for preventing rotation of the stem and for taking up lost motion between the stem and column comprising: a longitudinal keyway in the outer wall of the stem having a bottom wall and divergent inclined planar opposite side walls; a pair of keys reciprocable in bores extending through the column wall and having each an end portion projecting into the keyway, one longitudinally spaced from the other; the key end portions having respectively inclined faces substantially co-planar with the opposite walls of the keyway; a pair of springs respectively holding the keys radially inwardly and holding the end portion faces in wedging engagement with the opposite walls of the keyway.

2. In a machine tool of the type comprising a main base and a tubular column rising from the base and a stem guided for vertical movement within the column to adjust the elevation of a tool supported by the column, and means to adjustably reciprocate the stem in the column; improved means for preventing rotation of the stem and for taking up lost motion between the stem and column comprising: a longitudinal keyway in the outer wall of the stem having divergent inclined planar opposite side walls; a pair of keys reciprocable in bores extending through the column wall and having each an end portion projecting into the keyway, one longitudinally spaced from the other; the key end portions having respectively inclined faces substantially co-planar with the opposite walls of the keyway; a pair of springs respectively holding the end portion faces in wedging engagement with the opposite walls of the keyway; the extreme inner end of one key being spring-held into engagement with the bottom of the keyway.

3. In combination with a tubular machine part having a cylindrical bore, and a load carrying cylindrical element guided therein for longitudinal movement to different positions; means preventing rotation of the cylindrical element in the bore and for taking up lost motion between it and the tubular part comprising: a longitudinal keyway in the outer wall of the cylindrical element having opposite side walls and a bottom wall; a pair of apertures in the tubular part wall opening into the keyway, one longitudinally spaced from the other; a pair of keys in the apertures reciprocably guided by aperture walls, and having inner end lateral portions projecting into the keyway, and respectively engaging the opposite walls of the keyway; resilient means yieldably holding the keys inwardly; the said engaging inner and lateral portion of one key, and one side wall of the keyway, being formed to convert the resilient inward holding force on the one key into torque on the cylindrical element in one rotary direction, and to prevent rotation of the cylindrical element in the other rotary direc-

tion; the inner end of the other key resiliently held in engagement with the keyway bottom wall; and the other side wall of the keyway held in engagement with the inner end lateral portion of the other key by said torque, and the engagement preventing rotation of the cylindrical element in the direction of the torque.

4. In a machine tool, a stationary part, and a rotary part adjustably rotatable thereon to a plurality of different positions; means to predetermine said positions relative to each other angularly, comprising a plurality of angularly spaced wedge form index grooves in the rotary part radial to its rotational axis; a pin support supported on said stationary part and having an eccentric through bore; and an index pin supported for longitudinal reciprocatory movement in said bore and having a tapering end portion reciprocable with the pin into and out of engagement with said grooves selectively and being adjustably movable on the stationary part transversely with respect to a pin engaged groove upon rotation of said pin support, to accurately adjust all of said positions of the rotary part relative to the stationary part.

5. In a machine tool, a motor driven tool support comprising a pair of spaced arms; a tool driving motor between the arms, adjustably rockingly supported thereon by spaced coaxial trunnion bearings; one trunnion bearing comprising: a first plate mounted on one side of the motor housing and having a first bearing bore therein, a first trunnion mounted on one arm and projecting into the first bearing bore; the other trunnion bearing comprising: a second plate mounted on the opposite side of the motor housing a bearing element supported by the motor housing axially outwardly of the second plate and having a second bearing bore therein, a second trunnion mounted on the other arm, and projecting into the second bearing bore and abutting at its end on the second plate; the first trunnion floating axially in the first bearing bore; spring means reacting axially between the first trunnion and the first plate and yieldably holding the motor housing toward the other bearing and holding the second plate in said abutting engagement with the second trunnion end; and operable means to lock the bearing element to the second arm in all rocked positions of the motor around the axis of the trunnion bearings.

6. In a machine tool, a motor driven tool support comprising a pair of spaced arms; a tool driving motor between the arms, adjustably rockingly supported thereon by spaced coaxial trunnion bearings; one trunnion bearing comprising: a first plate mounted on one side of the motor housing and having a first bearing bore therein, a first trunnion mounted on one arm and projecting into the first bearing bore and adjustably shiftable on the arm to adjust the first trunnion relative to the arm transversely of the trunnion axis; the other trunnion bearing comprising: a second plate mounted on the opposite side of the motor housing, a bearing element supported by the motor housing axially outwardly of the second plate and having a second bearing bore therein, a second trunnion mounted on the other arm, and projecting into the second bearing bore and abutting at its end on the second plate; the first trunnion floating axially in the first bearing bore; an annular shoulder on the first trunnion spaced axially from the first plate, an annular sheet metal spring surrounding the first trunnion between the shoulder and the first plate, and re-

acting thereon axially, and yieldably holding the motor housing toward the other bearing and holding the second plate in said abutting engagement with the second trunnion end; and operable means to lock the bearing element to the second arm in all rocked positions of the motor around the axis of the trunnion bearings.

7. In a machine tool having a work support, an arm overhanging the work support, and a trackway adapted to reciprocally support tool carrying means: a pivot construction supporting said trackway on said arm for rotation about a vertical axis comprising; a pivot element having an annular surface confronting an annular surface on the lower side of said arm; means to support said element for rotation about said axis; means securing said trackway to said element for rotation therewith, means for selectively frictionally engaging said annular surfaces to lock said element against rotation about said axis, and indexing means for determining the angular position of said element and said trackway with respect to said arm comprising, a plurality of angularly spaced radial index grooves on the upper side of said element, an index pin supported in a rotatably adjustable sleeve on the arm for manual reciprocation in a direction parallel to said axis, the pin having a lower end portion for selective engagement in said grooves, and the outer wall of said sleeve being eccentric to said pin whereby the pin may be laterally adjusted upon rotation of said sleeve.

8. In a machine tool having a work support, an arm overhanging the work support, and a trackway adapted to reciprocally support tool carrying means; a pivot construction supporting said trackway on said arm for rotation about a vertical axis comprising; a pivot plate having an annular surface confronting an annular surface on the lower side of said arm; means to support said plate for rotation about said axis; means securing said trackway to said element for rotation therewith; indexing means for determining the angular position of said plate and said trackway with respect to said arm comprising a plu-

5 rality of angularly spaced radial index grooves on the upper side of said plate; an index pin supported on said arm for manual reciprocation and rotation, said pin having a lower end portion for engagement in said grooves selectively; means in said arm to adjust said index pin relative to said arm in a direction transverse of a selected groove in which it is engaged; and means for frictionally engaging said annular surfaces to lock 10 said element and said trackway in adjusted angular position with respect to said arm.

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