

March 8, 1960

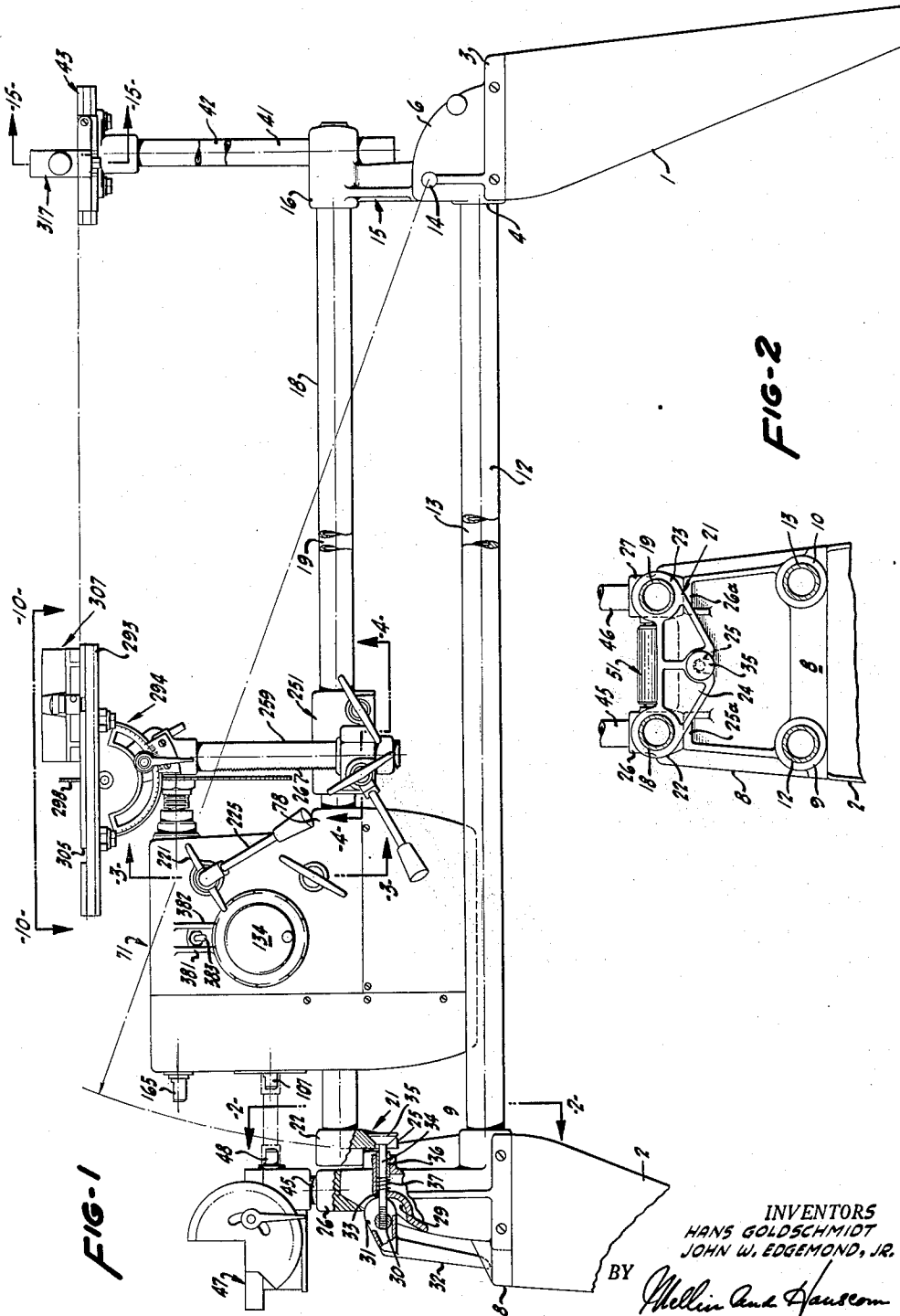
J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

7 Sheets-Sheet 1



INVENTORS
HANS GOLDSCHMIDT
JOHN W. EDGEMOND, JR.

BY

Mellin and Hanson

ATTORNEYS

March 8, 1960

J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

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FIG-3

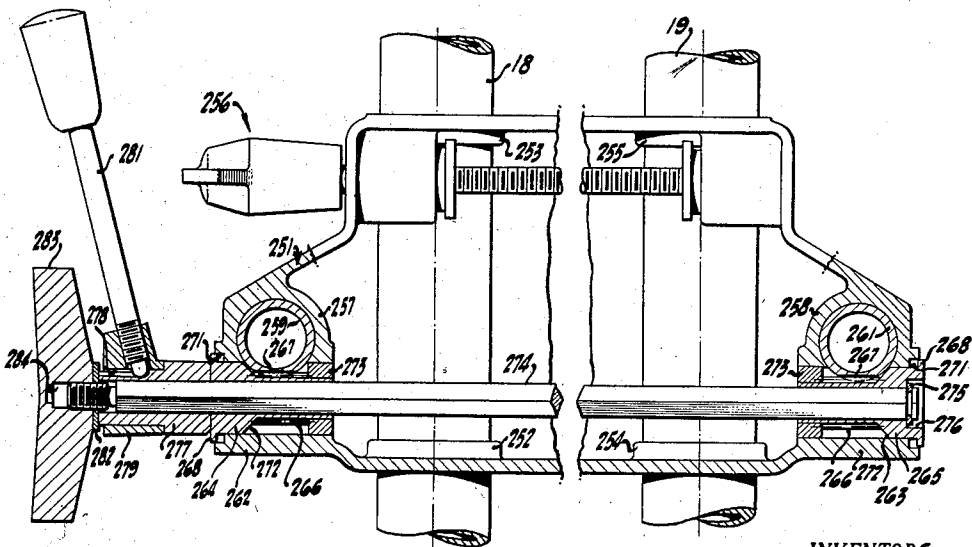
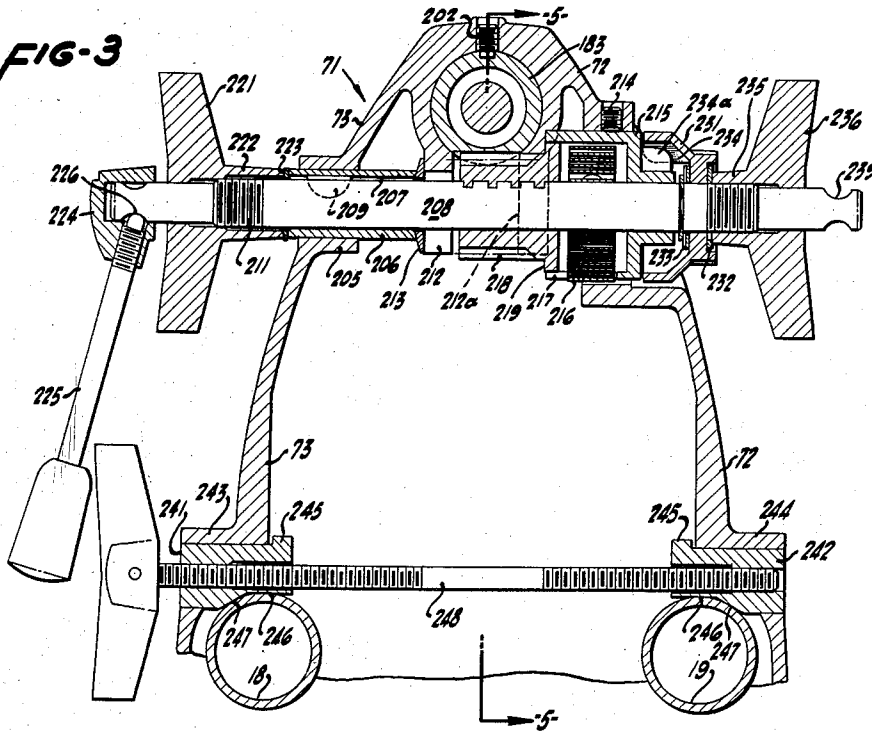


FIG-4

INVENTORS
HANS GOLOSCHMIDT
JOHN W. EDGEMOND, JR.

BY
Mellin and Paulson
ATTORNEYS

March 8, 1960

J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

7 Sheets-Sheet 3

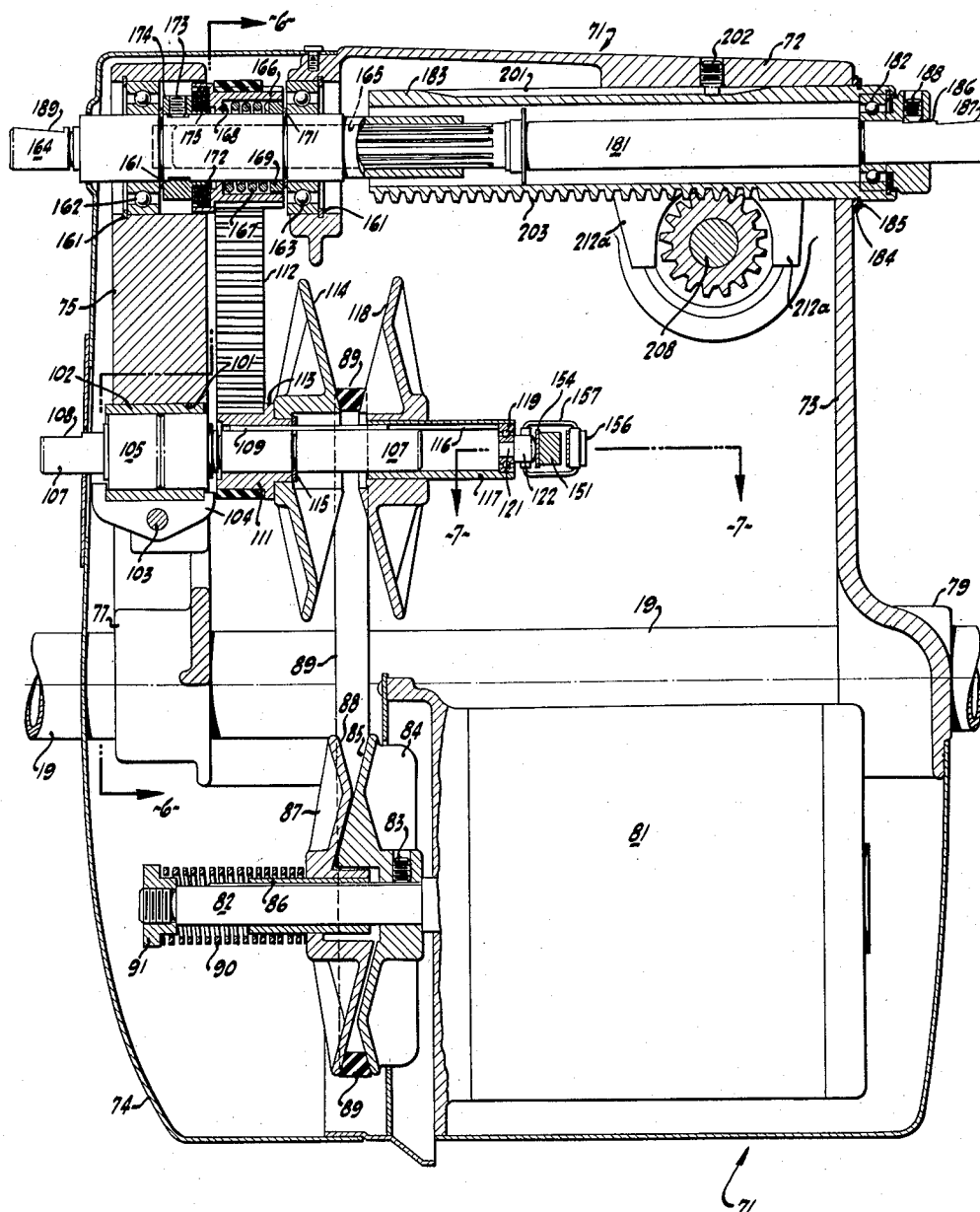


FIG-5

INVENTORS

HANS GOLDSCHMIDT
JOHN W. EDGEMOND, JR.

JOHN W. EDGEMOND, JR.

BY

BY *Mellin Anne Hauscom*

ATTORNEYS.

March 8, 1960

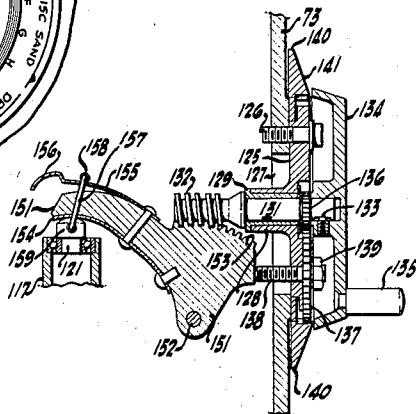
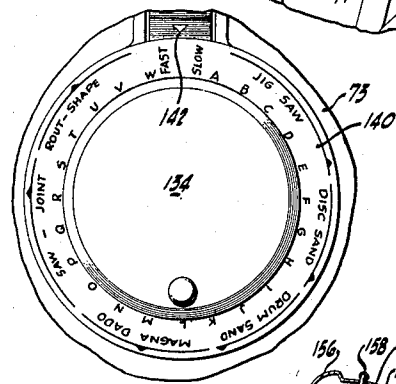
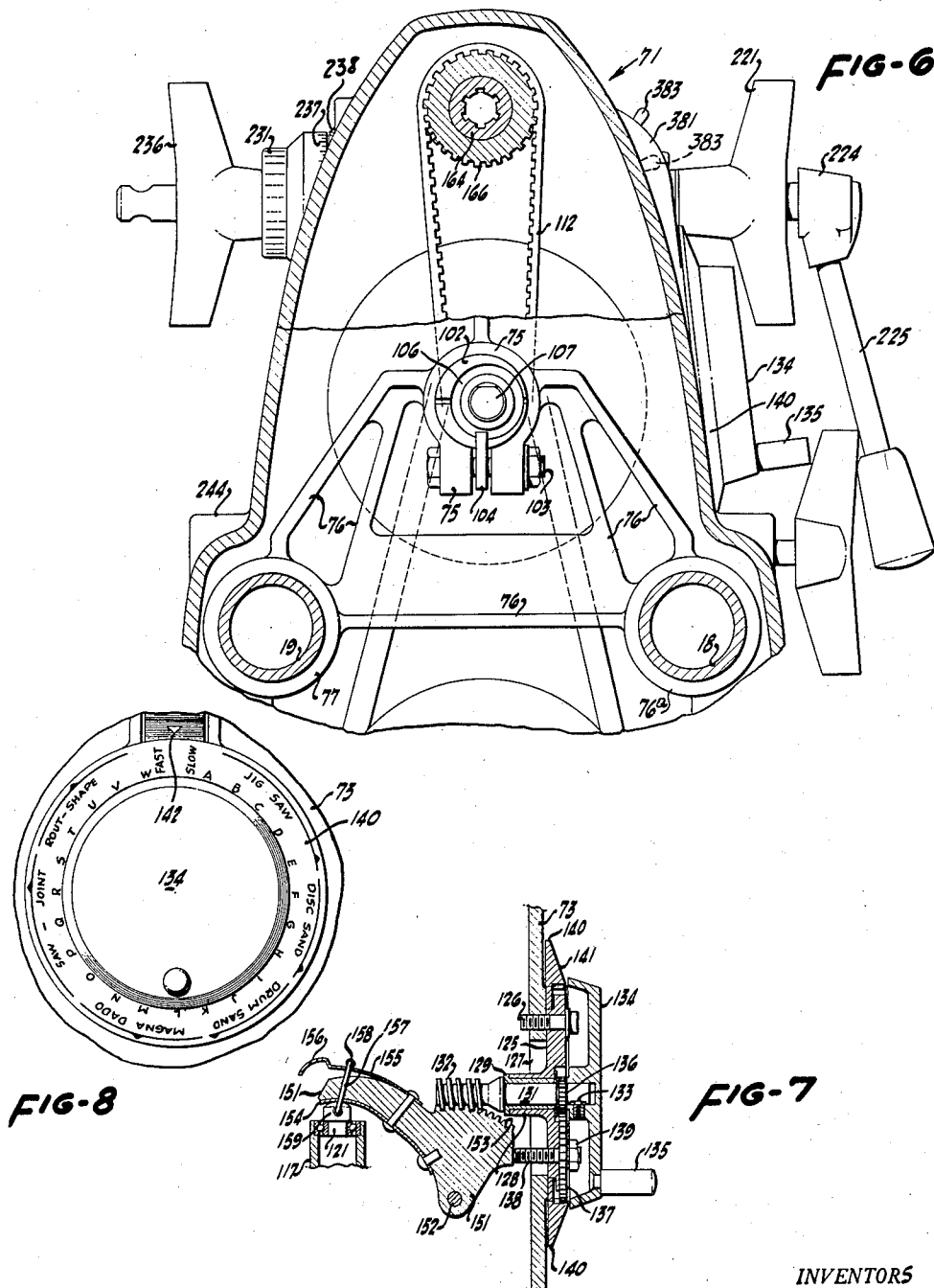
J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

7 Sheets-Sheet 4



INVENTORS
HANS GOLDSCHMIDT
JOHN W. EDMOND, JR.

BY *Mellin and Hancock*

ATTORNEYS

March 8, 1960

J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

7 Sheets-Sheet 3

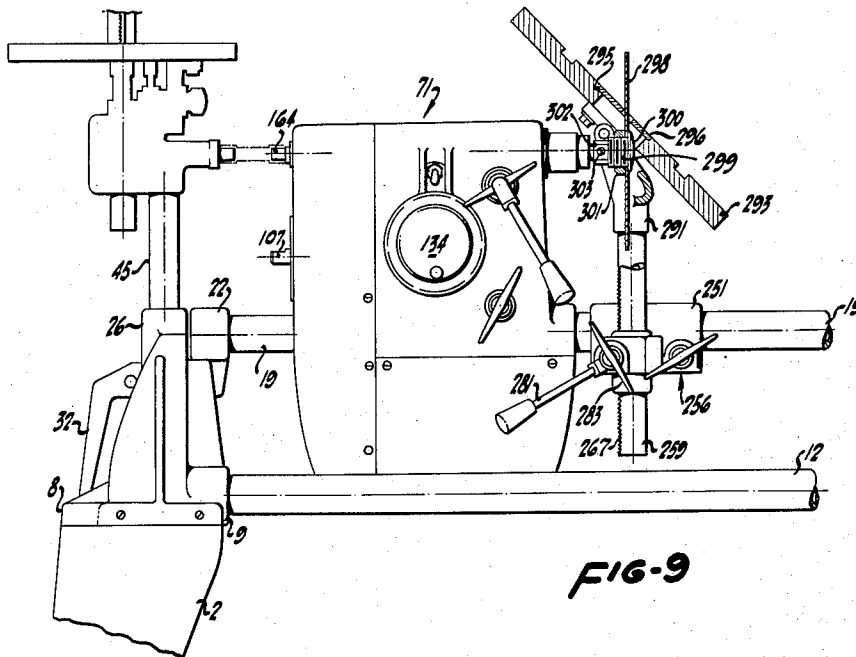


FIG-9

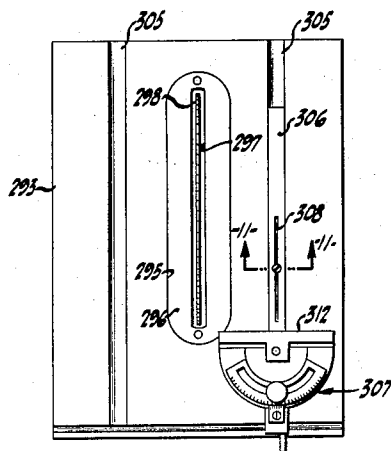
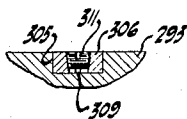


FIG-10



INVENTORS
HANS GOLDSCHMIDT
JOHN W. EDMOND, JR.

BY

BY *Mellin and Fauscom*

ATTORNEYS

March 8, 1960

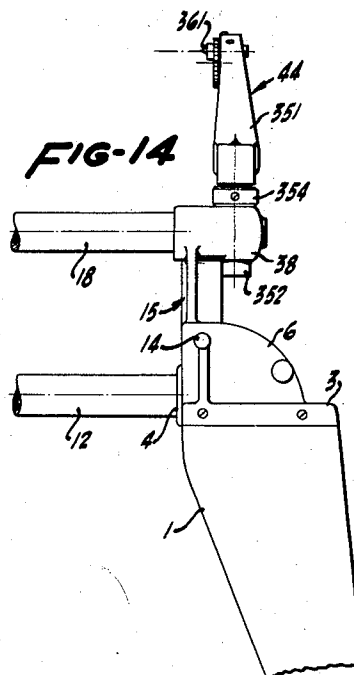
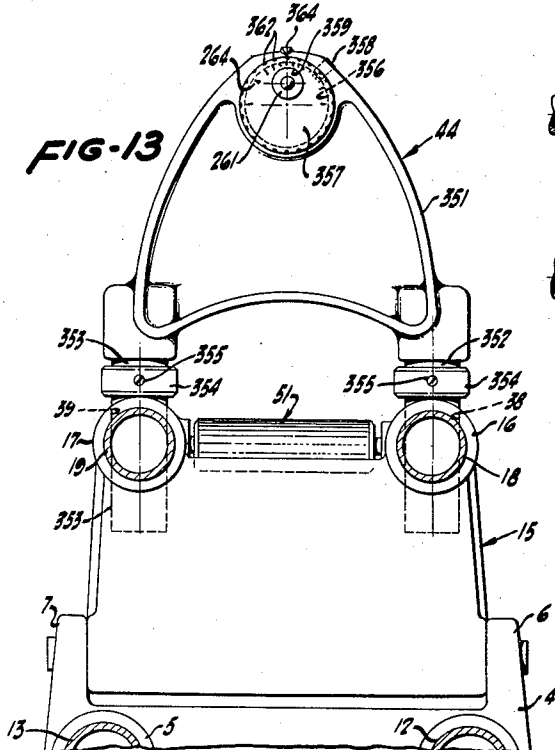
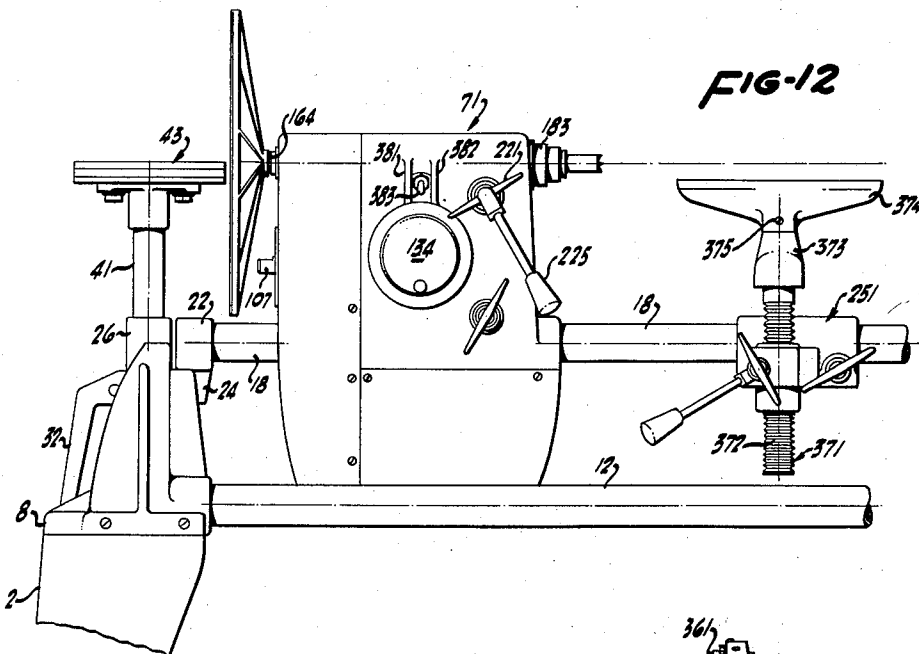
J. W. EDGEMOND, JR., ET AL

2,927,612

COMBINATION WOOD-WORKING MACHINE

Filed March 15, 1955

7 Sheets-Sheet 6



INVENTORS
HANS GOLDSCHMIDT
JOHN W. EDGEMOND, JR.
BY *Mellin and Jensen*
ATTORNEYS

March 8, 1960

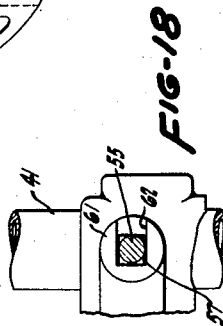
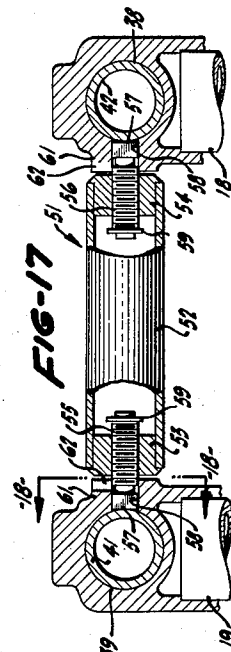
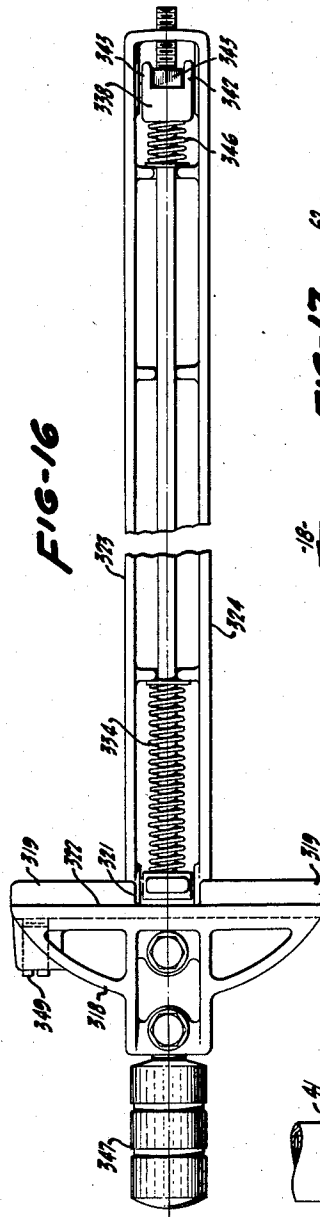
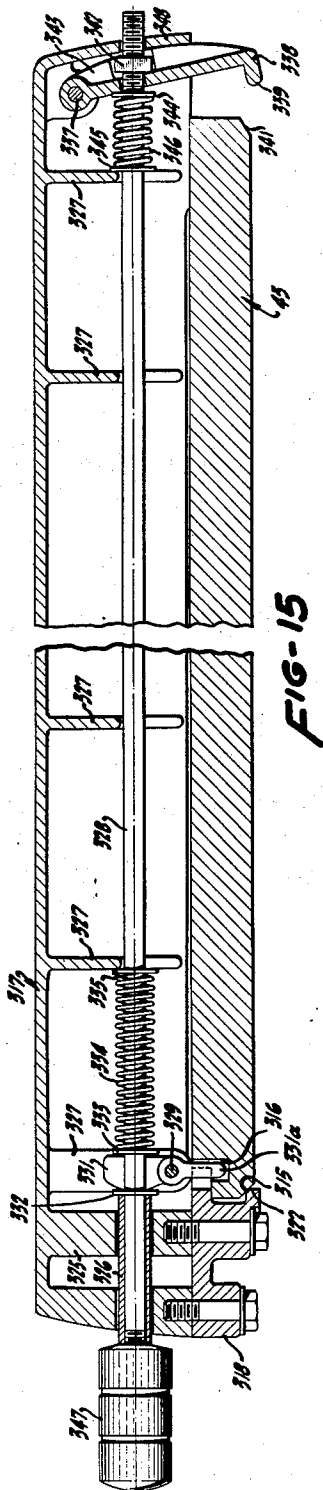
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2,927,612

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2,927,612

COMBINATION WOOD-WORKING MACHINE

John W. Edgemond, Jr., Los Altos, and Hans Goldschmidt, Atherton, Calif., assignors, by mesne assignments, to Yuba Consolidated Industries, Inc., San Francisco, Calif., a corporation of Delaware

Application March 15, 1955, Serial No. 494,468

6 Claims. (Cl. 144—1)

This invention relates to and in general has for its object the provision of a power tool which can be selectively used as a circular saw, sander, lathe, vertical drill press, jointer, or jig-saw and wherein two such tools can be simultaneously driven by a common motor selectively at either the same speed or at different speeds through a common speed reducer.

Some of the advantages of a combination or convertible tool of this character are that a single motor can be used to power a variety of tools, and that it requires a smaller amount of space than a comparable number of individual tools. However, in opposition to this it is urged by owners of individual tools that loss of time is incurred in making the conversions required when using a combination. To overcome this criticism it is in general the object of this invention to provide a combination home power tool of the type disclosed in the Goldschmidt Patent No. 2,623,629, issued December 30, 1952, wherein the required conversions can be made in the least amount of time and with the least amount of effort and wherein all of its operations are positive and simple and concur to produce a substantially complete and exceedingly flexible workshop.

Another object of this invention is the provision in a combination power tool of the character above described, of a headstock including a built-in motor provided with a drive shaft; an intermediate shaft driven by said drive shaft through a variable speed reducer and externally accessible as power drive; a quill shaft driven by said intermediate shaft and also externally accessible from the same end of the headstock for use as a power drive of a different speed; and a quill splined to said quill shaft and externally accessible from the opposite side of said headstock as an additional power drive.

A further object of this invention is the provision in a power tool of the character described of a tool mount for interchangeably mounting a selected auxiliary tool such as a jointer or jig-saw in axial alignment with either the intermediate shaft or quill shaft of the headstock above referred to by a flexible coupling.

A still further object of this invention is the provision of a power tool, including ways pivoted at one end to a base member and supported at their free ends on an inwardly extending shoulder formed on an auxiliary tool mount; and an auxiliary tool mounted on said tool mount, the free ends of said ways, said tool mount and said auxiliary tool being so correlated that said ways can be pivoted from their horizontal position to a vertical position while said auxiliary tool remains in its operative position.

Another object of this invention is the provision of a headstock provided with coaxial quill-advancing, depth-gauging and locking mechanisms.

Still another object of this invention is the provision of a headstock provided with a built-in motor, an intermediate drive shaft driven by said motor through a variable speed reducer, a quill and externally accessible quill shaft driven by said intermediate drive shaft, a

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speed-control crank for actuating said variable speed reducer, and a speed-indicating dial responsive to the movement of said crank, said dial bearing in proper sequence the names of the tools to be driven by either said intermediate shaft, said quill or said quill shaft at the speed for which said speed control crank is set.

Another object of the invention is the provision of a headstock provided with a built-in motor, a tumble type switch being mounted on the headstock casing with its actuator extending therethrough between a pair of spaced parallel guard ribs, said ribs being so contoured that when the switch is in its off position the actuator lies entirely within the confines of said guard ribs and when the switch is in its closed position the actuator extends beyond the confines of said guard ribs.

A further object of the invention is the provision in a combination tool of the character described, having a pair of tubular ways and a headstock or carriage slidably mounted thereon, of a positive acting lock for simultaneously securing the headstock to both of said tubular ways and which can be positively unlocked from both of said ways.

Another object of the invention is the provision in combination with a work-supporting table and a fence associated therewith of a novel lock, operable entirely from the front end of the table to first square and seat the fence with and to the front edge of the table and then positively lock the fence first to the front end of the table and then to the rear end thereof.

Another object of the invention is the provision in combination with a work-supporting table of a fence provided in its head with a set screw arranged to seat on the front end of the table and to enable the fence to be angled with respect to the table.

Still another object of this invention is the provision in combination with a work-supporting table and a miter slidable thereon of means for quickly locking said miter to said table in any selected position of the miter relative to the table.

Another object of this invention is the provision of an auxiliary tool, table extension or tailstock mount provided with a pair of transversely spaced, parallel, vertically extending sockets arranged to slidably receive a pair of mating posts depending from said auxiliary tool, table or headstock; a lock for detachably and simultaneously securing both of said posts to said mount in any selected position of said tool, table extension or tailstock relative to said mount.

A further object of this invention is the provision in combination with a tailstock, of an eccentric cup center mount for permitting offset turning.

This invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where those forms of the invention which have been selected for illustration in the drawings accompanying and forming a part of the present specification, are outlined in full. In said drawings, several forms of the invention are shown, but it is to be understood that it is not limited to such forms, since the invention as set forth in the claims may be embodied in other forms.

Referring to the drawings:

Fig. 1 is a front side elevation of a combination power tool embodying the objects of my invention.

Fig. 2 is a fragmentary vertical section taken on the section line 2—2 of Fig. 1 and through the headrest bracket and way-connecting yoke.

Fig. 3 is a vertical transverse section taken on the section line 3—3 of Fig. 1 and showing the quill assembly and headstock locking mechanism.

Fig. 4 is a transverse vertical section taken on the sec-

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tion line 4—4 of Fig. 1 through the table and tool-rest carriage and showing the carriage-locking mechanism.

Fig. 5 is a vertical longitudinal mid-section taken on the section line 5—5 of Fig. 3 showing quill and variable-speed drive assemblies.

Fig. 6 is a transverse vertical section taken on the section line 6—6 of Fig. 5.

Fig. 7 is a fragmentary horizontal section taken on the section line 7—7 of Fig. 5 showing the variable-speed dial and control mechanism of the device.

Fig. 8 is a front elevation of the speed dial.

Fig. 9 is a fragmentary front elevation of the tool set up as a circular and jig-saw combination with the circular saw work-supporting table shown in section and tilted to better illustrate the advantage of the saw arbor.

Fig. 10 is a top plan view of the working lathe as illustrated in Fig. 1 showing the table insert and miter.

Fig. 11 is a fragmentary horizontal section taken on the section line 11—11 of Fig. 10 and illustrating the tapered miter set screw and its coaction with the table miter slot.

Fig. 12 is a fragmentary front elevation of the tool set up as a disk sander and lathe combination.

Fig. 13 is a fragmentary end elevation of the tool, particularly showing the tailstock and tailstock mounting.

Fig. 14 is a fragmentary front elevation of the tailstock and tailstock mounting shown in Fig. 13.

Fig. 15 is a vertical mid-section taken through the work-supporting table and its associated fence on the section line 15—15 of Fig. 1.

Fig. 16 is a bottom plan view of the fence shown in Fig. 15.

Fig. 17 is a horizontal section taken through the way-supporting bracket and showing the lock for securing a tailstock or table extension thereto.

Fig. 18 is a vertical section taken through the section line 18—18 of Fig. 17.

As more generally shown in Fig. 1, the objects of our invention have been embodied in a combination tool including a pair of opposed identical steel bench ends 1 and 2. Screwed to the top of the bench end 1 is a bench base casting 3 provided with a pair of transversely spaced, longitudinally extending cross-tube receiving sockets 4 and 5 (Figure 13) disposed within the confines of a pair of transversely spaced webs or brackets 6 and 7. Similarly, screwed to the left bench end 2 is a bench base 8 (Figure 2) provided with a pair of transversely spaced, parallel, and inwardly extending cross-tube sockets 9 and 10 coaxial respectively with the sockets 4 and 5 of the opposed bench base 3. Receivable in these two pairs of sockets 4 and 5 and 9 and 10, and secured thereto, are a pair of parallel, longitudinally extending cross-tubes 12 and 13, the structure so far described constituting a rigid bench or supporting member.

Pivoted to and within the confines of the upper inner ends of the upstanding webs or brackets 6 and 7 by a pin 14 is a tool mount and way-supporting member 15 (Figure 13). Formed in the member 15 is a pair of parallel, transversely spaced, longitudinally extending sockets 16 and 17, and fixed to and within these sockets respectively is a pair of parallel, longitudinally extending, tubular ways 18 and 19. Connected to the free, left-hand ends of the tubular ways 18 and 19 and serving to hold them in parallelism with each other is a yoke generally designated by the reference numeral 21 (Figures 1 and 2) consisting of a pair of sockets 22 and 23 arranged to receive and be secured to the free ends of the tubular ways 18 and 19 provided with depending cross-web 24 formed with a central upwardly extending notch 25. Here it should be observed that the cross-web 24 is substantially offset to the right as illustrated in Fig. 1.

Extending upwardly from the left-hand end bench base 8 and formed as an integral part thereof is a shoulder 25a arranged to support the yoke 21 with the ways 18 and 19 in a horizontal position and a pair of parallel,

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transversely spaced and vertically extending cylindrical sockets 26 and 27. Extending between the sockets 26 and 27 and formed integral therewith is an intervening, upstanding web terminating substantially below the level of the sockets 26 and 27. Formed in the web in axial alignment with the notch 25 is a recess 29 and pivoted therein by a pin 30 extending through the side walls of the recess 29 is a bifurcated eccentric hold-down cam 31 arranged to cam against the end wall of the recess 29 and terminating in an operating lever 32. Extending through a hole 33 formed in the end wall of the recess 29 coaxially with the notch 25 is rod 34 threaded at one end to the pin 30 and provided at its opposite end with a cone-shaped head 35 arranged to seat in a dished recess formed on the inner side of the yoke web 24 coaxially with its notch 25. Surrounding the rod 34 and extending through the notch 25 is a spacing sleeve 36 and surrounding the rod 34 outwardly of the sleeve 36 is a coil spring 37 abutting the outer end of the sleeve 36 and the inner side of end wall of the recess 29 so as to bias the rod-head 35 away from its mating recess. The contour of the eccentric cam 31 is so formed that the downward movement of its lever arm 32 serves to draw the rod-head 35 into the mating recess formed on the inner side of notch 25 and therefore to hold the free ends of the ways 12 and 13 locked to bench base 8. Upon the upward movement of the lever 32, the rod 34 and its head 35 move inwardly, whereby the head 35 clears its mating recess and permits the ways 12 and 13 to be swung clockwise to a vertical position with the outer right-hand ends thereof seated on the bench base 3.

Formed in the pivoted way-supporting member 15 substantially in line with its sockets 16 and 17 but in a transverse vertical plane are a pair of transversely spaced, vertically extending sockets 38 and 39 arranged to slidably receive a pair of posts 41 and 42 of a table extension 43 as illustrated in Fig. 1, or in the alternative, of a tailstock 44 as shown in Figs. 13 and 14.

As illustrated in Fig. 1, the sockets 26 and 27 associated with the left-hand bench end and its bench base 8 constitute an auxiliary tool mount and are arranged to slidably receive the mating posts 45 and 46 of a selected auxiliary tool 47 such as a jointer and which is provided with an inwardly extending drive shaft 48.

Associated with the way-supporting member 15 and more particularly with its vertical sockets 38 and 39 and with the posts 41 and 42 receivable therein is a post lock generally designated by the reference numeral 51 (see Fig. 17). The lock 51 comprises an externally grooved or serrated hollow cylindrical hand grip 52 closed at each end by oppositely threaded nuts 53 and 54 rigidly fixed thereto. Threaded within each of the nuts 53 and 54 respectively are bolts 55 and 56 having square outer heads 57 receivable in square recesses 58 extending entirely through the inner walls of the sockets 38 and 39. Fastened to the inner ends of the bolts 55 and 56 are snap rings 59 serving to limit the outward movement of the bolts. Formed on one side of each of the inwardly extending boss extensions 61 of the sockets 38 and 39 is an open square notch 62 sufficiently large to permit the passage therethrough of the square bolt heads 57 when the bolts are in their retracted position. Upon the rotation of the hand grip 52 in one direction the bolt heads 58, when seated in the associated square recesses 58, are simultaneously forced outwardly into contact with the posts 41 and 42 and of necessity lock each of posts 41 and 42 to its respective socket 38 and 39 with equal pressure. This symmetry of action is of particular advantage when the posts 41 and 42 are used for supporting a table extension, for in many instances it is essential to have the table extension not only absolutely coplanar with a main work-supporting table, to be presently described, but also to have the corresponding edges of the two tables in absolute alignment so that a fence can be

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made to straddle the two tables and still be in proper alignment. Here it is to be observed that to make the posts 41 and 42 readily slidable within their associated sockets 38 and 39, positive clearance must be provided between these elements and that the lock above described serves to take up this clearance equally and simultaneously on both sides thereof. By this expedient then, the posts 41 and 42 and the table extension or other tool mounted can always be locked in proper alignment. To unlock the posts it is only necessary to turn the hand grip 52 in the opposite direction, and here it should be noted that in so doing the locking pressure between the posts and their sockets is simultaneously relieved and that there is no possibility for binding at any point. This identical locking structure is also associated with the left-hand end of the bench for locking auxiliary tools to their tool mount.

It will be seen that thus far there has been described a combination tool comprising: a rigid bench; means at the right-hand end of the bench for pivotally supporting a pair of ways and for selectively and adjustably mounting devices, such as a table extension or tailstock; means associated with the left-hand end of the bench for supporting the left-hand ends of the ways and quickly detachably locking said ways thereto; further means associated with the left-hand end of the bench serving as an auxiliary tool mount for detachably mounting any selected auxiliary tool such as a jointer, jig-saw or the like; and means for positively locking tools in their proper position.

Slidably mounted on the ways 18 and 19 is a headstock generally designated by the reference numeral 71 and generally comprising a one-piece supporting casting and casing 72 closed at its right-hand end as viewed in Fig. 1 by a wall 73 formed integral therewith and having an open left-hand end arranged to be closed by a cover plate 74 (see also Figs. 3 to 8 inclusive). Formed on the left-hand end of the casing 72 as an integral part thereof or rigidly fixed thereto is a depending wall or bearing frame 75 formed with outwardly extending stiffening ribs or flanges 76. Provided along the lower end of the bearing frame 75 is a pair of parallel coplaner sockets or sleeve bearings 76a and 77 respectively for slidably receiving the tubular ways 18 and 19. Formed in the headstock end wall 73 in axial alignment with the sleeve bearings 76a and 77 is an additional pair of sleeve bearings 78 and 79 also arranged to slidably receive the tubular ways 18 and 19.

Mounted and rigidly secured within the lower portion of the headstock casing 72 is an electric motor 81 including a drive shaft 82. Fixed to the shaft 82 by a set screw 83 adjacent the left-hand end of the motor is a sheave 84 having an outwardly facing, conical-operating face 85. Splined to the shaft 82 by a spline 86 is a complementary sheave 87 having an inwardly facing, conical-operating face 88, the two faces 85 and 88 together defining a V-belt running friction surface of variable diameter for the reception of a complementary drive belt 89. Surrounding the shaft 82 in abutment with the end of the sheave 87 is a coil spring 90 and threaded to the free end of the shaft is a nut 91 arranged to receive and serve as a stop for the outer end of the spring. As a result of this construction, the outward axial movement of the outer sheave 87 proceeds against the biasing action of the spring 90 in the customary and well-known manner.

Formed in the wall or frame 75 is a split sleeve bearing socket 101 and receivable in this socket is a bearing sleeve 102, this sleeve being held in place by a bolt 103 extending through the split portion of the socket and by U-shaped key or retainer 104 (Figure 6) mounted on the bolt 103. Mounted in the sleeve 102 and secured thereto by the retainer 104 is a bearing assembly 105, including an eccentric bearing-retaining sleeve 106. Journaled within the bearing assembly 105 is a drive shaft 107 provided on its outer free end with a flat 108 (Figure 5). As a result of this construction it will be seen that

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the shaft 107 is supported by the frame 75 through its bearing assembly 105, cantilever fashion, and that consequently the width and length respectively of the frame and bearing assembly should be sufficient to properly take the loads imposed on them.

Splined to the shaft 107 inwardly of the bearing assembly 105 by a spline 109 is a sprocket 111 arranged to drive an upwardly extending, interiorly toothed drive belt 112 and provided with an intermediate belt guide flange 113. Fixed to the outer end of the sprocket 111 is a sheave 114, the sheave and the sprocket being held against axial displacement by a split retaining ring 115 secured to the shaft 107. Splined to shaft 107 by a spline 116 is a sleeve 117 and fixed thereto is a sheave 118 complementary to the sheave 114, and axially movable relative thereto, the two sheaves being arranged to receive the upper end of the belt 89. Mounted within and fixed to the free end of the sleeve 117 is a bearing 119 and journaled therein is a pin 121 having an enlarged, rounded outer end 122.

Associated with the pin 121 is a variable speed control mechanism for axially advancing and retracting the sheave 118 thereby to change the speed ratios between the motor shaft 82 and the drive shaft 107 (see Figs. 7 and 8 in addition to Fig. 5). Included in this mechanism is a circular plate 125 fastened by screws 126 to the forward side wall or face of the headstock casing 72, over a circular opening 127 formed therein. Extending inwardly from the plate 125 and formed integrally therewith is a boss 128 and fixed therein is a bearing sleeve 129. Journaled in the sleeve 129 is a shaft 131 formed at its inner end with a worm 132 and secured at its outer end by a screw 133 to an operating or control crank in the form of an interiorly recessed disk 134 provided at its periphery with an outwardly extending pin or finger grip 135. Fixed to the shaft 131 is a pinion 136 arranged to mesh with a gear 137 journaled on a pin 138 threaded to and through the plate 125, the longitudinal position of the pin 138 being fixed by a lock nut 139. To prevent the gear 137 from becoming locked against rotation by the nut 139, the gear is journaled on a spacing washer either fixed to or journaled on the pin 138. Journaled on the inner end of the circular plate 125 and meshing at its lower side with gear 137 is an annular speed dial 140 calibrated on its exposed beveled face 141 by reference to the tools which can be driven at any predetermined speed. To this end the headstock casing 73 is provided at a point adjacent the beveled or feathered edge of the dial 140 with a fiducial mark 142 and the names of the more common tools to be driven by the headstock are applied to the face of the dial in a progressive sequence corresponding to the speeds at which they should preferably be driven. The proper speed at which any given tool should be driven can then be obtained through the variable speed drive presently being described by simply rotating the disk 134 to a position wherein the name of the tool under consideration as inscribed on the speed dial 140 is opposite the fiducial mark 142.

To attain this end, a lever 151 is pivoted to an inwardly extending portion of the front face of the headstock casing by a pin 152. Formed on the upper outer end of the lever 151 is an arcuate rack 153 arranged to mesh with the worm 132. Secured to and along the lower inner side of the lever 151 is a cushioning leaf spring 154, the outer free end of which is arranged to seat on the rounded outer end 122 of the rotatable pin 121. Fastened to the upper face of the lever 151 is another leaf spring 155 formed at its outer end with a link retaining hook 156. Pivoted to the outer end of the pin 121 is a wire metal loop 157 provided on its upper and lower sides with small, anti-friction bearing sleeves 158 and 159, the bearing sleeve 158 being arranged to ride on the outer face of the leaf spring 155. It will be seen that as a result of this construction the rotation of control

crank or disk 134 causes the lever 151 to rotate about the axis of the pin 152 and that the rotation of the lever 151, depending upon the direction of rotation, results in the axial advance or retraction of the sleeve 117 and its associated sheave 118. If the sheave 118 is retracted the belt 89 will move downwardly into the V-shaped valley defined by the sheaves 114 and 118, the lower sheaves 84 and 87 will move towards each other under the biasing action of the spring 90 and all this will result in increasing the speed ratio between the motor shaft 82 and the drive shaft 107 all in a manner well known in the art.

Mounted in the upper end of the frame 75 and fixed thereto by snap rings 161 is a pair of axially spaced bearing assemblies 162 and 163 and journaled in these bearings is a drive shaft 164 formed with a central splined bore 165. Mounted on the drive shaft 164 with positive clearness is an externally toothed pulley 166 arranged to be driven by the internally toothed belt 112. Accommodated within an internal annular recess formed in the pulley 166 is a coil spring 167 having a thrust bearing at one end on a pulley shoulder 168 and a thrust bearing at its opposite end on a ring 169 accommodated within the confines of the pulley 166. Fastened to the shaft 164 adjacent the ring 169 is a snap ring 171 serving to hold the ring 169 and bearing assembly 163 against axial movement. Keyed to and within the outer left-hand end of the pulley 166 by internal gear teeth is a series of annular fiber rings 172. Fixed to the shaft 164 outwardly of and adjacent the pulley 166 by a set screw 173 is a stepped hub or sleeve 174 and keyed by external gear teeth to the stepped end of this sleeve, and which is circumscribed by the outer end of the pulley 166, is a series of steel rings 175 alternated with the annular fiber rings 172 and forming a friction clutch therewith. As a result of this construction it will be seen that the only connection between the pulley 166 and the drive shaft 164 is through the spring pressed alternated fiber and steel rings 172 and 175 and that if too great a load is imposed on the shaft 164 slippage will occur between the two sets of friction rings.

Splined to and within the interiorly splined drive shaft 164 through a substantial length thereof is an exteriorly splined quill shaft 181, the shaft 164 here also functioning as a bearing for the left-hand end of the quill shaft. Mounted on the right-hand end of the quill shaft 181 is a bearing assembly 182 and mounted on this assembly and circumscribing the quill shaft 181 is a quill 183 extending through the end wall of the headstock. The right-hand end of the headstock casing is formed as a bearing for the quill 183 at this point, and is split along its lower edge and provided with a pair of downwardly extending ears to be presently described. By squeezing these ears together the quill can be positively locked in any desired longitudinal position. Surrounding the quill 183 immediately adjacent the headstock is cushioning washer 184 and outwardly thereof is a retaining snap ring 185. Formed in the free end of the quill shaft 181 are flats 186 and 187, the former for securing the bearing assembly to the shaft by a set screw 188 and the latter for securing a tool to the shaft by a set screw threaded through the tool. The free end of drive shaft 164 is likewise provided with a flat 189 for the same purpose or for securing thereto a flexible coupling. Threaded through the top of the tailstock casing in longitudinal alignment with the quill 183 and receivable in a longitudinal slot 201 formed therein, is a screw 202 serving to restrain the quill against rotation. Formed in the lower face of the quill 183 is a rack 203 for advancing and retracting the quill and its associated shaft 181.

Associated with the rack 203 is a coaxial, quill-advancing, depth-gauging and locking mechanism mounted transversely of the headstock (see Fig. 3). More specifically, there is formed in the front face of the headstock casing a bearing 205 for slidably accommodating a sleeve 206

provided on its upper face with a longitudinally extending key-way 207. Mounted in the sleeve 206 is an axially immovable stepped shaft 208 keyed to the sleeve 206 by a key 209 extending into the key-way 207 and threaded as at 211 over a portion of its length external to the headstock casing 72. As previously explained, the right-hand end of the quill as viewed in Fig. 5 is slidably accommodated in a split bearing or sleeve formed integral with the top of the headstock casing at this point and this split bearing or sleeve is provided with a pair of opposed, depending, forked lugs 212 and 212a arranged to straddle the shaft 208. Mounted on the shaft 208 adjacent the right-hand end of the sleeve 206 is a washer 213 having a rounded outer face mating with dish end of the sleeve 206. Snugly mounted in the headstock casing and secured thereto by a set screw 214 is a spring housing and bearing 215, the right-hand end of the shaft 208 as viewed in Fig. 3, being journaled in this bearing. Fixed to the shaft 208 within the confines of the bearing and housing 215 is the inner end of a coiled ribbon spring 216, the outer end of this spring being anchored in a slot 217 formed in the lower end of the bearing and housing 215. Fastened to the shaft 208 in mesh with the quill rack 203 (Fig. 5) is a pinion 218 formed with a concentric circular flange 219 journaled in the open end of the spring housing and bearing 215.

Disposed over the left-hand end of the shaft 208 is an interiorly recessed wing nut 221 formed with an interiorly threaded hub 222 threaded to the shaft 208. Surrounding the shaft 208 and the outer end of the sleeve 206 is a split-spring washer 223. Mounted over the free left-hand end of the shaft 208 (as viewed in Fig. 3) is a hub 224 and threaded therethrough is the inner end of a control lever 225 arranged to seat in a groove 226 formed in the end of the shaft. As a result of this construction it is possible to clamp the lever to the shaft when it is desired to rotate the shaft and its associated pinion 218, thereby to advance or retract the quill under the biasing action of the spring 216. When the quill has been advanced to a selected position it can then be locked in that position by turning the wing nut 221 which results in advancing the sleeve and forcing the washer 213 against the lugs 212 thereby to pinch the quill bearing around the quill. Here it should be noted that the flange 219 is seated against the right-hand side of the lugs 212a and that the flange 219 moves with the shaft 208.

Journaled on the right hand end of the shaft 208 is a quill depth-gauge cup 231 held in clearance with the bearing and spring housing 215 by a snap ring 232. Keyed to the shaft 208 on either side of the hub of the depth-gauge cup 231 are serrated washers 233 serving as a friction clutch for releasably locking the cup to the shaft. Formed interiorly of the cup 231 is a radially extending finger 234 arranged to overlap with and stop on a corresponding outwardly extending finger 234a formed on the bearing and spring housing 215 (Fig. 3). Threaded on the shaft 208 is the hub 235 of a wing nut 236 identical to the wing nut 221, the hub 235 being arranged to seat against a washer surrounding the shaft and seated within a recess formed in the outer end of the cup 231. Inscribed on the periphery of the cup 231 is a numerical scale 237 (Figure 6) calibrated in angular increments corresponding to the linear travel of the quill 183. As a result of this construction the quill can be set and locked in any predetermined position by the lever 225 and wing nut 221 and the extent of the desired additional travel of the quill determined by rotating the cup 231 until it has reached its zero position with the two fingers 234 and 234a in contact with each other and then rotating the cup in the reverse direction until the desired depth as indicated on the cup scale opposite a fiducial mark 238 inscribed on the exposed periphery of the bearing and spring housing 215. This having been done, the cup 231 is locked to the shaft 208 by the

wing nut 235. When the opposite wing nut 221 is unlocked, the quill will then retract to its initial or zero position under the influence of the spring 216 and then can be advanced a total distance equal to the distance to which the quill was originally set (if any) plus the desired additional travel by turning the lever 225 as far as it will go, that is, until the two fingers 234 and 234a contact each other. This same mechanism can be used for gauging the return movement of the quill. If desired, the lever 225 and its hub 224 can be mounted on the right-hand end of the shaft 208, a groove 239 being provided for this purpose.

Here it should be noted that tools can be driven from each of the drive shafts 107, 164 and 181; that the shafts 164 and 181 always rotate at the same speed, but at a lower speed than shaft 107, and that the speed of all of these shafts can be simultaneously varied by simply rotating the crank disk 134. With this arrangement, two companion tools, such as a jointer and circular saw, can be simultaneously driven respectively from the shafts 107 and 181, or a tool such as a jig-saw can be driven from the shaft 164 simultaneously with any other tool such as a disk sander driven at the same speed from the quill shaft 181.

Associated with the headstock is a lock for simultaneously locking it to both of the ways 18 and 19 by the action of a single screw. As best shown in Fig. 3, this lock includes a pair of generally cylindrical, identically opposed shoes 241 and 242 slidably receivable in axially aligned sockets or bearings 243 and 244 formed in the front and rear sides of the headstock casing 72 in intersecting alignment with the ways. Formed on the inner end of each of the shoes 241 and 242 is a stop flange 245 and formed on the lower side of each of the shoes is a flat offset 246 merging with the body thereof through an inclined flat plane 247. From an inspection of Fig. 3 it will be seen that the offsets 246 are on a level with the upper side or zenith of the ways 18 and 19, whereas the inclined planes 247 extend well below this point so as to have a wedging action on the ways. Threaded through the shoes 241 and 242 respectively by right and left-hand threads is a rod 248 and fixed to the front end (left-hand end as viewed in Fig. 3) of the rod is a wing nut. It will be seen that as a result of this construction, rotation of the rod 248 in a counterclockwise direction will move both of the shoes outwardly out of locking engagement with the ways, the steps 246 here serving to prevent the shoes from rotating. There can be no possibility for either shoe to remain in wedging engagement with its associated shoe, for once one of the stop flanges 245 has engaged the adjacent headstock wall, the continued turning of the rod 248 will perforce positively move the opposed shoe outwardly. By turning the rod 248 in a clockwise direction, one or both of the shoes will move inwardly. As soon as the inclined plane 247 of one shoe engages its adjacent way, then the other shoe will start to move inwardly until its inclined plane engages its adjacent way. Thereafter the pressures between the two shoes and two ways will be equalized so as to uniformly lock both sides of the headstock to the ways without any tendency to misalign the headstock due to the positive clearances required between the various parts of the lock.

Mounted on the ways 18 and 19 is a table and tool rest carriage and mount comprising a carriage 251 (Figs. 1, 4, and 9) of generally rectangular form and provided on its opposed ends with two transversely spaced longitudinally aligned pairs of sockets or bearings 252, 253, 254 and 255 arranged to slidably receive the ways 18 and 19.

Associated with the carriage 251 is a carriage lock generally referred to by the reference numeral 256 and identical in construction to the lock just described with reference to Fig. 3 and which therefore requires no further explanation.

Formed in the carriage 251 outwardly of the ways 18 and 19 is a pair of parallel, vertically extending sockets or bearings 257 and 258 arranged to slidably receive a pair of table-supporting posts 259 and 261, or in the alternative, the socket 257 can slidably receive a tool rest post. Journaled in a pair of horizontal, transversely extending bearings 262 and 263 formed in the carriage 251 in intersecting relationship with the bearings 257 and 258 are pinion barrels 264 and 265 provided with teeth 266 arranged to mesh with racks 267 formed on the posts 259 and 261. Provided on the outer end of each of the pinion barrels 264 and 265 is a flange 268 receivable respectively in recesses 271 formed in the sockets or bearings 262 and 263 thereby to permit substantial lateral movement of the pinion barrels. Formed intermediate the ends of each of the pinion barrels are cone surfaces 272 arranged to wedgingly engage the straight surface of the posts 259 and 261 upon the inward movement of the pinion barrels 264 and 265. Fixed to the inner ends of the barrels are rings 273 journaled in the sockets or bearings 262 and 263. This lock will operate even though only one post such as the post of a tool rest is mounted on the carriage. Assuming that this post is the post 259, it will be seen that although there is no post 261 to limit the forward movement of shoe 265, its forward movement will nevertheless be arrested when the flange 268 is seated within the recess 271 of the bearing 263. A single post then can be locked and unlocked just as well as two posts.

Slidably extending through and keyed to barrels 264 and 265 is a square shaft 274 and fastened to the rear end (right-hand end as viewed in Fig. 4) is a snap ring 275 receivable in a recess 276 formed in the outer end of the barrel 263. Keyed to the front end of shaft 274 is a sleeve 277 formed with a longitudinally extending slot 278 and journaled on the outer end of the sleeve 277 is a hub 279. Threaded in the hub 279 is an inclined control lever 281 arranged upon the inward travel to seat in the slot 278. By this expedient the hub 279 can be quickly and detachably keyed to the sleeve 277, thereby to rotate the shaft 274 and its associated pinion barrels 264 and 265, provided that these elements have not previously been locked against rotation.

Mounted over the threaded front end of the shaft 274 is a washer 282 and threaded to the shaft is a wing nut 283 formed with an internal axial recess 284 for permitting some substantial movement of the wing nut on the shaft 274. To lock the posts after they have been elevated to any desired position by the rotation of the lever 281, it is only necessary to turn the wing nut 283 in a clockwise direction for this causes the shaft 274 to pull the rear pinion barrel forwardly and to push the front pinion barrel rearwardly so as to bring the pinion cones 272 into simultaneous and uniform wedging relationship with the side walls of the posts. If desired, the lever 281 can be withdrawn from the slot 278 in which event it will swing freely on the sleeve 277.

Mounted on and across the upper ends of the posts 259 and 261 is a table mount yoke or bracket 291 (Figs. 1 and 9) and pivoted thereto for swinging movement on a transverse horizontal axis is a work supporting table 293. Associated with the bracket 291 and table 293 is a locking mechanism generally referred to by the reference numeral 294 for locking the table in any desired degree of tilt in either direction (Fig. 1).

Formed in the table 293 is a generally rectangular rabbeted opening 295 (Fig. 10) for the flush reception of a mating table insert 296, and provided in the table insert 296 is a generally rectangular saw slot 297 for the reception of a circular saw 298 mounted on the quill spindle 181.

Although the saw can be attached to the quill spindle 181 by a conventional arbor when beveled cuts are being made, the arbor illustrated in Fig. 9 can be used to advantage to gain additional clearance between the

outer end of the arbor and the bottom of the table 293. To this end the arbor shown in Fig. 9 comprises a bolt 299 arranged to receive the hub of the saw 298 and which bolt is provided with a relatively shallow rounded head 300. Threaded over the bolt 299 is a nut 301 for locking the saw to the bolt head 300 and formed in the end of the bolt is a bore 302 arranged to receive the end of the quill spindle 181, a set screw 303 being provided for locking the bolt to the spindle. As a result of this construction, the use of a nut adjacent the outer face of the saw has been avoided and greater clearance between the table and the arbor obtained.

Formed in the table top are a pair of transversely extending channels 305 (Figures 10 and 11) each arranged to receive the bar 306 of a miter gauge assembly generally designated by the reference numeral 307. Provided in the bar 306 is longitudinal slot 308, the bar 306 being intersected intermediate its ends by a threaded tapered hole 309 arranged to receive a tapered set screw 311 normally flush with the upper face of the bar. By these expedients the bar can be wedge against and locked to the side walls of either channel 305 in any desired position, thereby to permit the cross-head 312 of the miter assembly 307 to serve as a fixed longitudinal guide, this being very convenient in certain operations, particularly when used in conjunction with a fence.

As previously described, the posts 41 and 42 mounted in the way-supporting member 15 (Fig. 1) are arranged to support a generally rectangular table extension 43, the height of which can be made coplanar with the main work-supporting table 293 and locked in such position by the locking mechanism described with particular reference to Figs. 17 and 18. Preferably, the lower edge 315 (Figure 15) of the front end of the table extension 43 is beveled and made absolutely perpendicular to the sides of the table extension. The main work-supporting table 293 is similarly constructed; in addition thereto the miter bar channels 305 (Figure 10) are made perpendicular to the beveled front end of the table. Furthermore, the beveled edge of the table extension should be collinear with the beveled edge of the main table when two tables are coplanar, and the two tables should be of the same length.

Provided in the front end of each of the tables in parallelism therewith is a channel 316. Mounted on either of these tables is a transversely extending fence 317 (Figures 15 and 16) of inverted channel shape and bolted to the underside thereof at its front end is a cross-head 318. Extending inwardly from the cross-head and over-hanging the channel 316 is a flange or ledge 319 provided with a control notch 321. Provided on the lower inner side of the cross-head is a straight gauging edge 322 perpendicular to the parallel faces 323 and 324 of the fence 317. Slidably mounted in the front end of the fence and through a web 325 formed therein is a sleeve 326, and extending through said sleeve and completely through the fence and through its notched stiffening webs 327 is a rod 328. Pivoted on a pin 329 mounted in the front notched stiffening web 327 is a first-class lever 331. The upper end of this lever operates between a washer 332 abutting the rear end of the sleeve 326 and a washer 333 biased by a coil spring 334 surrounding the rod 328. Seated against the opposite end of the spring 334 is a washer 335 backed by one of the notched webs 327. The lower end of the lever 331a extends through the notch 321 and is loosely accommodate in the channel 316. Pivoted to a pin 337 fixed to the rear end of the fence is a depending clamp 338 formed with an inwardly extending rounded lip or flange 339 in horizontal alignment with the lower beveled edge 341 of the table 43. Threaded to the rear end of the rod 328 is a square nut 342 keyed against rotation within a pair of parallel vertical webs 343 on clamp 338. Mounted on the rod 328 are washers 344 and 345, the washer 344 being backed by the clamp 338 and the washer 345 being backed by the adjacent web

327. Disposed between the washers 344 and 345 and surrounding the rod 328 at this point is a coil spring 346. It should be particularly noted here that the spring 346 is substantially stiffer than the spring 334, for the operation of this device depends largely upon this difference. Threaded and fixed to the front end of the rod 328 is a cylindrical operating hand-hold 347 for rotating the rod 328.

In Fig. 15, the fence is shown in its open unclamped position. To lock it to the table the hand-hold 347 is rotated clockwise and since the rear spring 346 is stiffer than the front spring 334, the rod 328 moves to the right; the lower end 331a of the lever 331 moves to the left and upon engaging the left-hand wall of the channel 316 serves to draw the wall fence assembly to the right until the adjacent gauging edges 315 and 322 are in line contact with each other. Since at this point the rod 328 cannot move further to the right, the continued counter-clockwise rotation of the rod will cause the clamp 338 to move to the left until its lip is firmly clamped against the beveled edge 341 of the table. In unlocking the fence, the reverse sequence of action takes place, the clamp 338 is first disengaged and then the lower end 331a moves out of engagement with the table. Here then there has been provided spring biased tandem clamps operated by a single rod entirely from the front end of the table and in a sequence wherein the fence cross-head is first gauged to the gauging edge of the table before the rear clamp locks the entire device.

In Figs. 12 and 14 there is illustrated one of the many dual combinations to which our combination tool can be converted. Here a disk sander is driven from the left end of the headstock in combination with a table extension locked in the left-hand tool mount. Driven by the quill spindle is a lathe drive center working in conjunction with a tailstock cup center shown in Figs. 13 and 14 as supported on a tailstock 351. Included as an integral part of the tailstock are a pair of depending tubular posts 352 and 353 slidably receivable in the sockets 38 and 39 of the way-supporting member 15. Mounted on each of the posts 352 and 353 is a stop or gauging collar 354 arranged to seat on the upper faces of the sockets 38 and 39 and to be locked to the posts by set screws 355 after the tailstock has been properly centered in relation to the axis of the quill spindle 181. Once this adjustment has been made, there is no further need for unlocking the stop collars.

Provided in the upper end of the tailstock 351 is a socket 356 and receivable therein is a cup center mounting disk 357 arranged to be locked within the socket in any angular position by a set screw 358. Formed in the disk 357 is an off-center tapered bore 359 for the snug reception of a tapered tailstock cup-center 361. Provided on the periphery of the mounting disk 357 are indentations or kerfs 362 for enabling the disk to be rotated by a screw driver or other tool. Inscribed on the exposed face of the disk is a fractional inch scale and provided at the upper end of the tailstock is a fiducial mark 364. By this structure the cup-center 361 can be laterally offset to any desired extent as indicated by the scale to permit offset turning. In an operation of this kind the tailstock should be raised to bring the headstock and tailstock centers back into horizontal alignment.

The tool rest illustrated in Fig. 12 includes a tubular post 371 of a diameter equal to the diameter of the table posts 259 and 261 (Figs. 1, 4, and 9). This post is therefore receivable in the carriage socket 257. Provided on the post 371, entirely around its surface, is a rack 372 arranged to mesh with the pinion 266 regardless of the angular position of the post. Fixed to the upper end of the post is an arm 373 and swiveled in the upper end thereof is a tool rest head 374 arranged to be locked to the arm in any desired angular position by a set screw 375. As a result of this construction the angular position of the head rest 374 relative to the work can be

adjusted either by the set screw 375 or by bodily rotating the assembly on the axis of the post 371. Furthermore, the entire assembly can be raised by the annular rack 372 without in any way disturbing its angular position.

Extending outwardly from the front side of the headstock casing 72 are a pair of laterally spaced, vertically extending guard ribs 381 and 382 (Figs. 1 and 12) of a depth which progressively increases from top to bottom. Mounted to the casing 72 within the confines of said ribs is the tumbler or control lever 383 of an electric switch disposed within the headstock for controlling the motor 81. The switch should be in its open position when the lever 383 is in its down position and disposed entirely below the level of the guard ribs 381. Conversely, when the switch is in its closed position, its operating lever 383 is in its upwardly extending position. The depth and contour of the guard ribs 381 and 382 should be so correlated to the length and position of the lever that when the lever is in its down position with the switch open, it lies entirely below the confines of the guard ribs and is relatively inaccessible, but readily accessible when in its up position. As a result of this construction, the danger involved in accidentally closing the motor circuit is materially reduced.

We claim:

1. A combination power tool comprising a frame assembly providing a pair of spaced apart pairs of vertical sockets, tubular ways between said sockets, a headstock slidable on said ways and having a pair of power take-off shafts spaced apart in a vertical plane extending from one of its ends, an auxiliary tool which is provided with vertical depending parallel members adapted to be accepted by a pair of said sockets and which is provided with a driven shaft adapted to be connected to one of said power take-off shafts whereby said auxiliary tool may be vertically adjustably mounted in a predetermined selected optimum working position and means for releasably securing said depending parallel members in said sockets.

2. A combination home power tool comprising: a frame assembly providing pairs of permanently spaced apart parallel vertical sockets, a pair of parallel tubular ways supported between said pairs of sockets, a headstock slidable on said ways and having a pair of power take-off shafts spaced apart in a vertical plane and extending from one of its ends, an auxiliary tool which is provided with vertical depending parallel members adapted to be accepted in a pair of said sockets and which is provided with a driven shaft adapted to be connected to one of said power take-off shafts whereby said auxiliary tool may be vertically adjustably mounted in a predetermined selected optimum working position, the frame, headstock and auxiliary tool being constructed so that said take-off shafts and said driven shafts all lie in the same vertical plane, and clamping means associated with said sockets and adapted to lock said vertical depending parallel members therein.

3. A combination power tool comprising: a frame assembly providing a plurality of spaced apart pairs of vertical sockets and a pair of parallel horizontal tubular ways, a headstock slidable on said ways and having a pair of power take-off shafts spaced apart in a vertical plane extending from one of its ends and a third power take-off shaft extending from its other end, an auxiliary tool which is provided with vertical extending parallel members

adapted to be accepted by one of said pairs of sockets and which is provided with a driven shaft adapted to be connected to one of said power take-off shafts whereby said auxiliary tool may be vertically adjustably mounted in a predetermined selected optimum working position and means for releasably securing said depending parallel members in said sockets.

4. A combination power tool as in claim 3 in which said frame, headstock and auxiliary tools are constructed so that the take-off shafts and the driven shafts all lie in the same vertical plane.

5. A combination power tool comprising: a frame assembly providing a pair of permanently spaced apart pairs of parallel vertical sockets, a pair of tubular ways supported between said sockets, the headstock slidable on said ways having a pair of power take-off shafts spaced apart in a vertical plane extending from one of its ends and a third power take-off shaft extending from its other end, a body slidably mounted on the ways having a third pair of spaced parallel vertical sockets, each pair of parallel vertical sockets adapted to support an auxiliary tool which is provided with vertical depending parallel tubes adapted to be received by said sockets and which is further provided with a driven shaft which is adapted to be operatively connected to one of said take-off shafts whereby said auxiliary tool may be vertically adjustably mounted in a predetermined selected optimum working position and means for releasably securing said depending parallel members in said sockets.

6. A combination power tool as claimed in claim 5 in which the frame, headstock and auxiliary tools are so constructed that the take-off shafts and the driven shafts all are in the same vertical plane.

References Cited in the file of this patent

UNITED STATES PATENTS

350,053	Guttinger	Sept. 28, 1886
456,380	Kidder	July 21, 1891
703,749	Stimpson	July 1, 1902
1,226,825	Stewart	May 22, 1917
1,434,564	Ruetschi	Nov. 7, 1922
1,526,575	Wood	Feb. 17, 1925
2,089,362	Haas	Aug. 10, 1937
2,089,363	Haas	Aug. 10, 1937
2,106,288	Tautz	Jan. 25, 1938
2,166,703	Boice	July 18, 1939
2,200,799	Miller	May 14, 1940
2,257,744	Heyer	Oct. 7, 1941
2,259,899	Long	Oct. 21, 1941
2,270,009	Rath	Jan. 13, 1942
2,340,054	Grunewald	Jan. 25, 1944
2,502,124	Bray	Mar. 28, 1950
2,556,595	McNickle	June 12, 1951
2,562,246	Van Dam et al.	July 31, 1951
2,564,160	Jones	Aug. 14, 1951
2,619,135	Callaway	Nov. 25, 1952
2,623,269	Goldschmidt	Dec. 30, 1952
2,646,144	Crichton et al.	July 21, 1953
2,661,037	McGihon	Dec. 1, 1953
2,677,400	Gaskell	May 4, 1954
2,710,633	Oberg	June 14, 1955
2,728,364	Muehling	Dec. 27, 1955

FOREIGN PATENTS

239,792	Switzerland	Mar. 1, 1946
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