Nov. 25, 1941. L. G. LARSEN 2,263,635

SLOTTING MACHINE

Filed Dec. 29, 1939 2 Sheets-Sheet 1

Fig. 1.

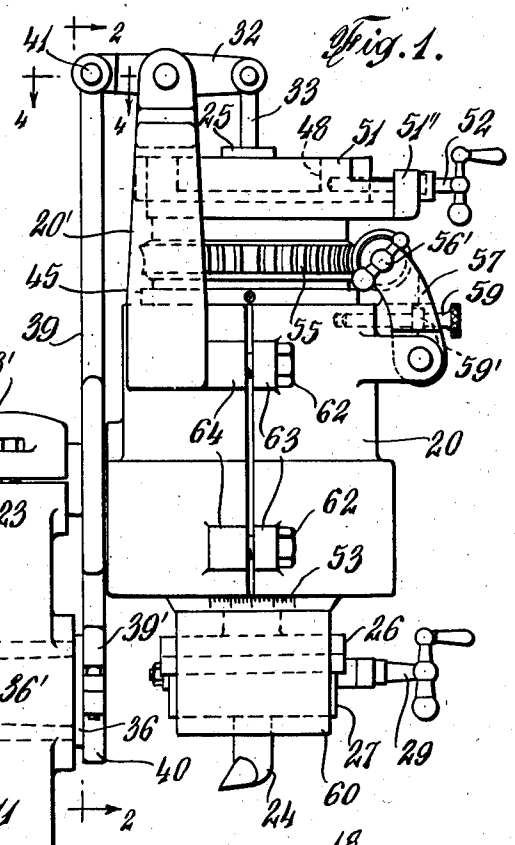


Fig. 2.

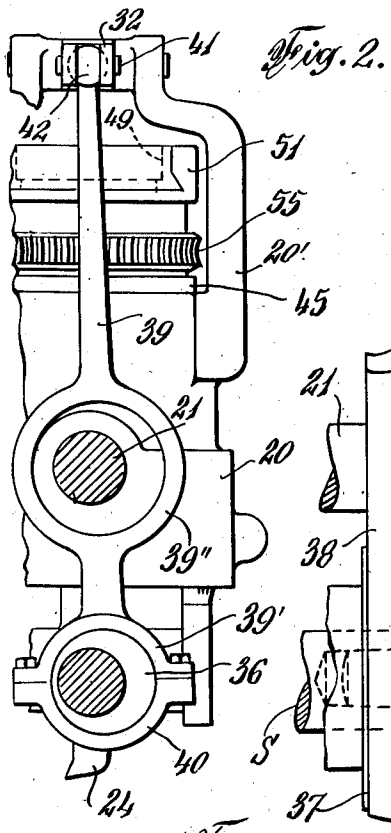


Fig. 4.

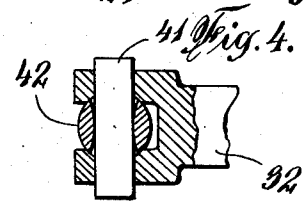
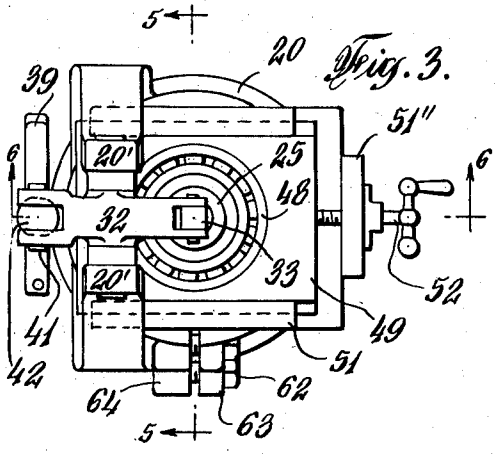


Fig. 3.



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Fig. 5.

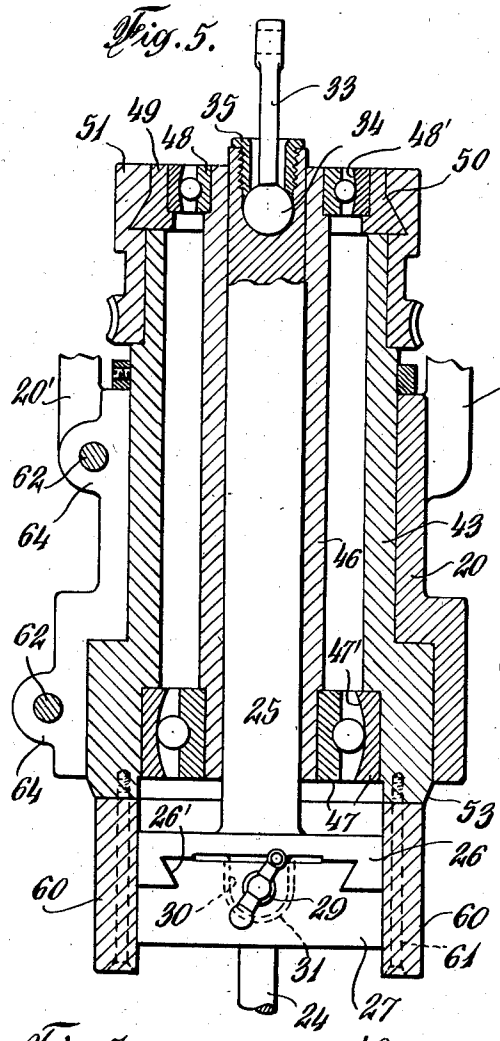


Fig. 6.

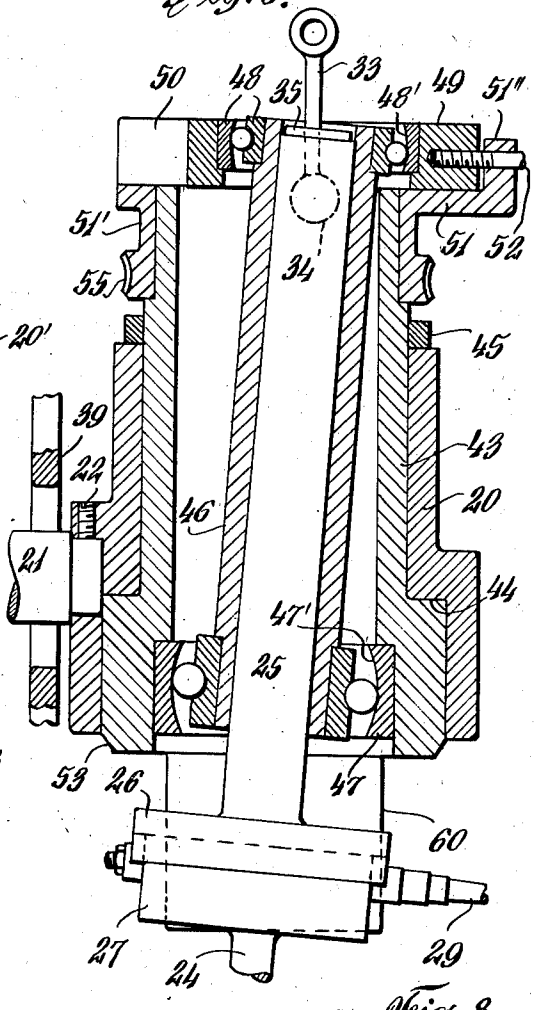


Fig. 7.

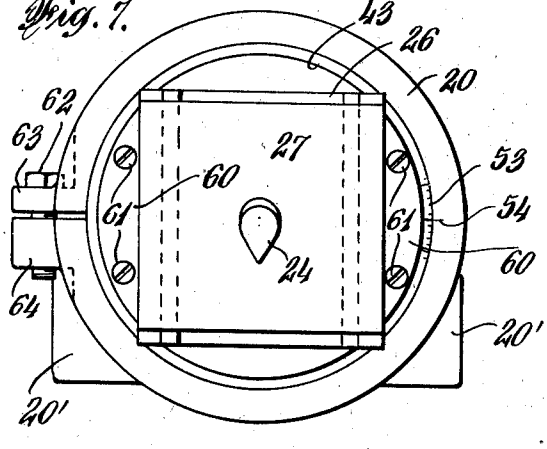
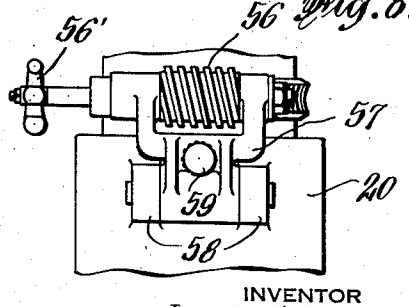


Fig. 8.



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UNITED STATES PATENT OFFICE

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SLOTTING MACHINE

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Application December 29, 1939, Serial No. 311,466

15 Claims. (Cl. 90—44)

This invention relates to machine tools, and while the invention is not limited to any particular use it is especially adapted for use as a slotting machine for cutting slots in metal plates or blocks to constitute blanking dies and produce dies of this character without requiring hand work to finish the dies.

It is the primary object of the invention to provide an improved machine for cutting slots in plates or blocks to form blanking dies, which is capable of cutting slots of rectangular or other form wherein the walls of the slot extend at a right angle to the face of the die or at different angles oblique to the face of the die to provide clearance when it is to be used as a stamping or blanking die, and to cut the corners at the juncture of two angular portions of a slot wall, thus eliminating the necessity of forming said portions of the slot wall by hand, and to provide a machine of this character which is simple in construction and efficient in use.

It is another object of the invention to provide in a machine of this character improved adjustment means to support and guide a tool carrier with the tool to have reciprocatory movement toward and away from the work support, adapted in one position of adjustment thereof to be reciprocated perpendicular to the work support, and in other positions of adjustment guide the tool carrier to reciprocate in planes oblique to the perpendicular relative to the work support and move the tool progressively laterally relative to the work to produce diagonal cuts and vary the angle of cut of the tool, and to effect adjustment of the tool carrier with the tool to change the direction of movement of the tool carrier with the tool and change the direction of cut by the tool to cut corners at the juncture of angular wall portions of a slot, or at the juncture of arcuate and angular wall portions of a slot, as well as cut irregular wall portions of a slot and cut recesses laterally into arcuate or angular wall portions of a slot in the die plate.

Other objects and advantages of the invention will hereinafter appear.

In the drawings accompanying and forming a part of this application,

Figure 1 is a side elevation of a machine showing an embodiment of the invention with a portion of the supporting frame broken away.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a view looking at the top of the right hand portion of Figure 1.

Figure 4 is a sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a longitudinal sectional view taken on the line 5—5 of Figure 3 showing the guiding means for the tool carrier in one position of adjustment.

Figure 6 is a longitudinal sectional view taken on the line 6—6 of Figure 3 showing the guiding means for the tool carrier in another position of adjustment.

Figure 7 is a view looking at the bottom of Figure 5; and

Figure 8 is an elevational detailed view showing the mounting of a worm wheel for adjusting the support for the guiding means for the tool carrier.

In the embodiment of the machine for carrying out the invention illustrated in the drawings only so much of the frame work is shown as is essential to an understanding of the invention, and comprises a supporting base arranged with a bed 9 having a horizontal surface 10 and a standard 11 extended upwardly at the rear of said bed. A conventional form of support for the work, such as a plate or block for forming a die, is mounted on the bed to have adjustment rearwardly and forwardly as well as lengthwise of the machine and consists of a table 12 slidably mounted on the bed to have adjustment rearwardly and forwardly thereof, which is effected by means of a crank applied to the end of lead screws 13 having an operative connection (not shown) with the table 12. An auxiliary table 14 is mounted on the table 12 to participate in the adjustment thereof, said auxiliary table having a dovetail recess 15 therein extending lengthwise of the machine for the slidable engagement of a correspondingly formed portion of a slide 16 to have sliding movement in a direction transversely of the adjustment of the table 12, said slide being adjusted by a crank 17 connected to a lead screw having an operative connection with the slide. The work or blank W is secured to the top of the slide 16 relative to spacing members 17' by clamping members 18 engaging over a marginal portion of the work and the clamping members 18 secured by bolts 19 the heads of which engage in inverted T slots in the slide, as shown in Figure 1.

A longitudinal split tubular member 20 is supported by an arbor 21 to be disposed in a vertical plane above the work support W by engaging the reduced end of the arbor in a socket

in the side of the tubular support and secured thereon to retain the tubular support in vertical position by suitable means, as by a set screw, as shown at 22 in Figure 6. The arbor is supported in the bearing 23 at the top of the support 11 and secured therein by a cap 23' secured to the bearing by screws.

A tool 24 is mounted on a carrier therefor to have reciprocatory movement toward and away from the work on the work support, said tool carrier including a post 25 having a head 26 at one end arranged with a dovetail slideway 26' extending longitudinally of the face thereof opposite the post, and a slide 27 carrying the tool 24 centrally thereof is arranged with a portion conforming to and slidably engaging in the dovetail recess in the head. The slide is adjusted longitudinally of the head by a spindle 29 having a crank connected thereto and rotatably mounted in the head 27 and having threaded connection intermediate the ends thereof with a perforated ear 30 extended downwardly from the bottom of the head 26 and engaging in a longitudinal recess 31 in the slide 27, as shown in dotted lines in Figure 5.

To support and longitudinally reciprocate the tool carrier the post is connected at the end opposite the head 26 to one arm of a lever 32 by a link 33 pivotally mounted on a pin extending between and fixed at the ends in arms 20' extending upwardly from the tubular support 20 at diametrically opposite sides thereof. The opposite end of the link 33 is provided with a globular member 34 adapted to be seated in a socket in the end of the tool post 25 the end wall of which is in an arc of a circle having a radius the same or slightly longer than the radius of the globular member 34, the globular member being retained in said socket and thereby the post connected to the link by a tubular member 35 threaded into the socket, the end of said member 35 engaged in the socket being arranged of arcuate form to conform to the curvature of the globular member and engaged therewith to hold it to its arcuate seat in the end of the socket, as shown in Figures 5 and 6 and having an annular laterally extending flange at the opposite end arranged for the engagement of a manipulating member to screw said tubular member into the socket in the post. The lever 33 is rocked to reciprocate the tool carrier from an eccentric 36 having a tapered stem 36' arranged axially of and extended laterally therefrom engaged in a tapered bore in a shaft S rotatably supported at one end in a bearing in the standard 11 of the frame, said shaft having a pulley 37 fixed thereon for the engagement of a belt 38 to rotate the pulley and thereby the shaft from a suitable source of power.

The lever 32 is rocked from the eccentric 36 by a link or pitman 39 having a semi-circular portion 39' at the end engaging a peripheral portion of the eccentric and connected in operative connection with the eccentric by a semi-circular strap 40 engaging the periphery of the eccentric opposite to and connected to the circular portion 39' of the pitman. The opposite end of the pitman is connected to a bifurcation at the end of the lever 32 opposite the tool carrying post 25 to have universal movement relative to the lever by a pin 41 extended through a transverse opening in a globular portion 42 at said end of the pitman and supported at the opposite ends in the bifurcation legs of the lever arm, the opposite faces of which bifurcation legs are provided with arcuate recesses conforming to the curvature of the globular portion 42, and the opening in said globular portion being of progressively increasing diameter from midway the ends to the outer surface of said globular portion, as shown in Figure 4, to permit of slight rotative movement of the pitman relative to the axis of pin 41. The pitman has an enlarged portion 39'' intermediate the ends having an opening therein for the passage of the supporting arbor 21 for the tubular support 20.

The tool carrying post 25 extends through and is reciprocated in the tubular support 20 toward and away from the work support through its connection with the lever 32 and the actuation of the latter from the eccentric 36, and means adjustably carried in the tubular support is adapted to be engaged by and guide the tool carrier to cause it to reciprocate axially of the tubular support 20 and perpendicular to the work support and the tool to pass through an opening in the work or die plate and produce cuts extending at a right angle to the face of the work, or to be reciprocated in different or varying planes oblique to the perpendicular and the axis of the tubular support to cause the tool as it passes through the work or die plate to move progressively laterally and produce diagonal cuts by the tool, and to vary the extent of such lateral movement of the tool to vary the angle of cut by the tool, and to rotatably adjust the tool carrier to change the direction of reciprocation thereof and lateral movement of the tool. For this purpose a sleeve 43 is mounted in the tubular support 20 to have rotative adjustment and held against endwise movement by an annular flange at one end of the sleeve, shown as the lower end, engaging a shoulder formed by an enlargement of the bore in the tubular support, as at 44, and the sleeve supported and held to said shoulder by a collar 45 engaged on the sleeve 43 and secured thereon in abutting relation to the end of the tubular support 20 by a set screw.

A guide member in the form of a second sleeve of less diameter than the internal diameter of the sleeve 43, in which the tool carrying post 25 is slidably engaged, is supported at one end in one end of the sleeve 43, in the present instance the lower end, by a self-alining bearing of the ball bearing type 47, whereby the guide member is adapted to be positioned to extend axially of the sleeve 43 and tubular support and to be tilted to extend at different angles inclining to the axis of the sleeve 43. The outer ring of the bearing is secured in an annular enlargement at the end of the bore in the sleeve 43 and has an arcuate inner ball engaging surface 47' arranged in an arc of a circle whose center lies in the axis of the sleeve 43, and the inner ring of the bearing is secured on the reduced end of the guide member and is provided with an annular ball engaging raceway intermediate the ends of arcuate form in cross section concentric of the balls.

The guide member or sleeve 46 is supported at the opposite end by a self-alining bearing of the ball bearing type 48, the outer ring of which bearing is mounted in a slide 49 slidably carried by the sleeve 43 to have adjustment transversely thereof, the inner ball engaging surface 48' of which ring is also in an arc of a circle whose center lies in the axis of the sleeve 43, and the inner ring is secured on the reduced end of the guide member and has an annular ball engaging raceway intermediate the ends of arcuate form in cross section concentric of the

balls. The slide 49 is slidably mounted in a slideway 50 in a member 51, the slideway having dovetail portions engaged by correspondingly shaped portions of the slide. The member 51 is arranged with a laterally extending annular flange 51' whereby it is mounted upon the reduced end of the sleeve 43 with the slideway extending transversely of the end of said sleeve and secured thereto, as by a set screw or otherwise. To adjust the slide and retain it in adjusted position a spindle 52 having a crank or hand wheel connected thereto is rotatably supported in a flange 51'' extended upwardly from the member 51 at one end of the slideway therein, the stem having screw threaded connection with the slide 49, as shown in Figures 1, 3 and 6, whereby when the stem is rotated in one direction the slide is adjusted in one direction and when the stem is rotated in the opposite direction the slide is adjusted in the opposite direction. Assuming the slide has been adjusted to position the guide member 46 and tool carrying post 25 to extend axially of the sleeve 43 and perpendicular to the work support, as shown in Figure 5. The tool carrying slide 27 in such position of the parts is then adjusted to position the tool relative to an opening in the die plate and as the tool carrier is reciprocated the tool 24 will produce cuts at a right angle to the face of the work or die plate. To cut a wall extending longitudinally of the die plate the slide 16 of the work support is adjusted with the work longitudinally of the machine by rotating the crank 29, and to cut a slot wall extending transversely of the die plate the bed 12 with the slide 16 and work is adjusted rearwardly or forwardly according to the direction in which the slot wall is to be extended by rotating one of the lead screws 13. To change the angle of cut by the tool and arrange the slot with the wall extending diagonally to the face of the plate the slide 49 is adjusted to tilt the guide member 46 and cause the tool carrying post to reciprocate in a plane oblique to the axis of the sleeve 43 and to a line extending perpendicular to the work support, as shown in Figure 6, and such adjustment of the guide member is in accordance with the desired angle of the cut to be produced by the tool.

To change the direction of cut by the tool, as in cutting the corners of a rectangular opening in a die plate, or to provide the slot with an arcuate wall portion, the sleeve 43 with the guide member 46 and tool carrier is adjusted about its axis in the tubular support 20, and such adjustment of the sleeve 43 indicated by the relation of graduations on the beveled end portion 53 of the sleeve 43 relative to an indicator line 54 (Figure 7) on the end of the tubular support 20.

To impart rotative movement to the sleeve 43 it is provided with the worm wheel 55, shown as arranged on the annular flange 51' of the member 51 having the slideway 50. The worm wheel is rotated by a worm 56 rotatably supported in a bracket 57 mounted on a pin supported in ears 58 extended from the tubular support 20, said worm, or the shaft on which the worm is arranged or mounted being provided with a crank 56' to rotate the same. The worm and worm gear are adapted for effecting fine adjustment of the tubular support 20 with the guide member 46 and tool carrier carried thereby. To permit of adjustment of the sleeve 43 by hand independently of said worm and worm wheel the worm carrying bracket 57 is pivotally supported by the ears 58 whereby the worm is adapted to be moved into and out of mesh with the worm wheel. The bracket is secured in position with the worm in mesh with the worm wheel by a stem 59 having a knurled head extended through an opening in the bracket with an annular enlargement 59' on the stem abutting the bracket and adapted to have screw threaded connection with an opening in the tubular support 20, as shown in Figure 1.

To couple the tool carrier with the sleeve 43 to participate in the rotative movement of the sleeve and permit of reciprocatory movement of the tool carrier, guide plates 60 are extended downwardly from the lower end of the sleeve 43 at opposite sides of the head 26 and the tool carrying slide 27 carried by said head. The guide plates 60 may be integral with the sleeve 43, but are preferably constructed independently of said sleeve and attached thereto, as by screws 61. By the arrangement of the ball and socket connection 34 between the tool carrying post 25 and its supporting link 32 said post is adapted to participate in the rotative adjustment of the sleeve 43 and guide member 46 without interfering with the reciprocatory movement of the tool carrier.

The tubular support 20 is longitudinally split to facilitate mounting the sleeve 43 therein, which is effected by loosening the screws 62 engaging perforations in ears 63 extended laterally from the tubular support 20 and having threaded connection with openings in ears 64 also extended laterally from said tubular support. After the sleeve 43 has been engaged in the tubular support 20 the split ends of the tubular support are drawn together by the screws 62.

It will be obvious that various modifications may be made in the construction and arrangement of the parts without departing from the scope of the invention, and that portions of the invention may be used without others and come within the scope of the invention.

Having described my invention, I claim:

1. In a slotting machine including a work support, a fixed tubular support disposed perpendicular to the work support, a tool carrying post, means to support said post to have adjustment about its axis within the tubular support and adjustment to different angular positions relative to the axis of the tubular support and operative to reciprocate said post toward and away from the work support, a guide member slidably engaged by and rotatable with the tool carrying post, and means to mount said guide member in the tubular support to have rotative adjustment with the tool carrying post about its axis, and said mounting means adjustable transversely of the tubular support and adapted in one position of adjustment to position the guide member to cause the tool carrying post to reciprocate in a plane perpendicular to the work support and in other positions of adjustment thereof position the guide member to cause the tool carrying post to reciprocate in different planes oblique to the perpendicular.

2. In a slotting machine including a work support, a fixed tubular member disposed perpendicular to the work support, a sleeve adapted for the slidable engagement of a tool carrying post, and means adjustable transversely of the axis of the tubular member to mount said sleeve within the tubular member, and said mounting means in one position of adjustment thereof adapted

to support the sleeve to extend axially of the tubular member and perpendicular to the work support and in other positions of adjustment thereof support the sleeve to extend at different angles to the axis of the tubular member.

3. In a slotting machine including a work support, a fixed tubular member disposed perpendicular to the work support, a sleeve, a tool carrying post longitudinally reciprocatory in said sleeve, and means to adjustably mount the sleeve in the tubular member whereby the sleeve in one position of adjustment of its mounting means is adapted to extend axially of the tubular member and guide the tool carrying post to reciprocate perpendicular to the work support and in other positions of adjustment of said mounting means incline at different angles to the axis of said tubular member and guide the tool carrying post to reciprocate in different planes oblique to the perpendicular and change the angle of the cut, and adjust the sleeve with the tool carrying post about the axis of the tubular member and guide the tool carrying post to reciprocate in different directions and change the direction of cut by the tool.

4. In a slotting machine including a work support, a fixed tubular support disposed perpendicular to the work support, a reciprocatory head, a tool carrying post supported by said head to extend through the tubular support in a plane perpendicular to the work support and to have adjustment to different positions oblique to the perpendicular and about its axis and reciprocatory by the head toward and away from the work support, a sleeve slidably engaged by and to guide the tool carrying post in the reciprocatory movements thereof, and means to adjustably mount the sleeve in the tubular member adapted in one position of adjustment to position the sleeve to extend axially of the tubular member and to guide the tool carrying post to reciprocate in a plane perpendicular to the work support and in other positions of adjustment to extend in different planes oblique to the perpendicular to change the angle of cut of the tool, and to have adjustment with the tool carrying post about the axis of the tubular support to change the direction of cut of the tool.

5. In a slotting machine including a work support, a fixed tubular support disposed perpendicular to the work support, a sleeve rotatable in said tubular support, a tool carrying post within said sleeve, means to longitudinally reciprocate the tool carrying post toward and away from the work support, and a guide member slidably engaged by and adapted to guide the tool carrying post in the reciprocatory movement thereof mounted in said sleeve to have adjustment at one end transversely of the sleeve and adapted to be adjusted to guide the tool carrying post to reciprocate in a plane axially of the sleeve and tubular support and reciprocate in planes oblique to said axis of the tubular support and change the angle of cut of the tool and to participate with the tool carrying post in rotative adjustment of the sleeve to change the direction of angle of cut of the tool.

6. In a slotting machine including a work support and a tool carrier reciprocatory toward and away from the work support, means to guide the tool carrier in the reciprocatory movements thereof to change the angle of cut and the direction of cut of the tool carried by the tool carrier, comprising a fixed tubular support disposed perpendicular to the work support, a sleeve mounted to have rotative adjustment about its axis in the tubular support, and a guide member engaged by and guiding the tool carrier in the reciprocatory movements thereof, means to support said guide member at one end axially in the sleeve and permit of adjustment of the guide member to extend axially of and at angles oblique to the axis of the sleeve, means to support the guide member at the opposite end adjustable transversely of the sleeve, and means to adjust said adjustable supporting means for the guide member to position the guide member to cause the tool carrier to reciprocate in a plane axially of the tubular support and perpendicular to the work support and to position the guide member to cause the tool carrier to reciprocate in planes oblique to the axis of said tubular support and change the angle of cut by the tool, and said guide member and tool carrier adjustable with the sleeve to change the direction of cut by the tool.

7. In a slotting machine as claimed in claim 6, means to rotate the sleeve, comprising a worm wheel rotatable with the sleeve, a worm, and means to mount the worm on the tubular support to have adjustment into and out of mesh with the worm wheel.

8. In a slotting machine including a work support and a tool carrier reciprocatory toward and away from the work support, a fixed tubular support disposed perpendicular to the work support, a guide member engaged by and adapted to guide the tool carrier in the reciprocatory movements thereof, and means to adjustably mount the guide member operative in one position of adjustment to guide the tool carrier to reciprocate in a plane perpendicular to the work support and in other positions of adjustment reciprocate in planes oblique to the perpendicular and change the angle of cut by the tool, comprising a self alining bearing supporting said guide member at one end axially of the tubular support, and a self alining bearing supporting the guide member at the opposite end to have adjustment transversely of the tubular support and adapted to adjust the guide member on its support axially of the tubular member to extend in a plane perpendicular to the work support and to positions to extend in different planes oblique to the perpendicular.

9. A slotting machine as claimed in claim 8, wherein the self alining bearings for supporting the guide member comprise ball bearing members.

10. In a slotting machine as claimed in claim 8, means to rotatably support the supporting bearings for and the guide member in the tubular support to have angular adjustment about the axis thereof to change the direction of reciprocation of the tool carrier and direction of cut by the tool.

11. In a slotting machine as claimed in claim 8, a sleeve rotatably mounted in the tubular support, and the self alining bearings for supporting the guide member axially of the tubular support mounted in said sleeve, and the slide carrying the self alining bearing for the opposite end of the guide member slidably mounted on said sleeve to have sliding movement transversely thereof.

12. In a slotting machine as claimed in claim 8, means to rotatably support the bearing members for and the guide member in the tubular support to have angular adjustment about the axis thereof, and means to cause the tool carrier to participate in said adjustment of the guide member to

change the direction of reciprocation of the tool carrier and direction of cut by the tool.

13. In a slotting machine as claimed in claim 8, a sleeve rotatably mounted in the tubular support, and the self alining bearing for supporting the guide member axially of the tubular support is mounted in said sleeve and the slide carrying the self alining bearing for the opposite end of the guide member slidably mounted on said sleeve to have sliding movement transversely thereof, and the tool carrier comprises a slide slidably mounted in a head at one end of a post slidably engaging the guide member, and guide plates extended from the sleeve engaging at opposite sides of the head and slide of the tool carrier to cause the tool carrier to participate in the rotative adjustment of the sleeve and change the direction of reciprocation of the tool carrier and direction of cut by the tool.

14. In a slotting machine including a work support, a fixed tubular member disposed with the axis thereof extending substantially at a right angle to the work support, a sleeve adapted for the engagement of a tool carrier, and means to support and adjustably mount said sleeve in the tubular member adapted in one position of adjustment to support the sleeve to extend axially of said tubular member and in other positions of adjustment extend at different angles relative to the axis of the tubular member.

15. In a slotting machine including a work support, a fixed tubular member disposed with its axis extending perpendicular to the work support, a sleeve adapted for the slidable engagement and guiding of a tool carrier, means to mount and support the sleeve at one end in the tubular member to have adjustment on an axis extending transversely of the axis of the tubular member, and a slide supporting the sleeve at the opposite end adjustable transversely of the axis of the tubular member and adapted in one position of adjustment to position the sleeve to extend axially of the tubular member and perpendicular to the work support and in other positions of adjustment thereof to adjust the sleeve about its axis of support in the tubular member to extend at different angles relative to the axis of the tubular member.

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