(No Model.)

4 Sheets—Sheet 1.

L. H. COLBURN.

SLOTTING MACHINE.

No. 477,737. Patented June 28, 1892.

Fig. 1.

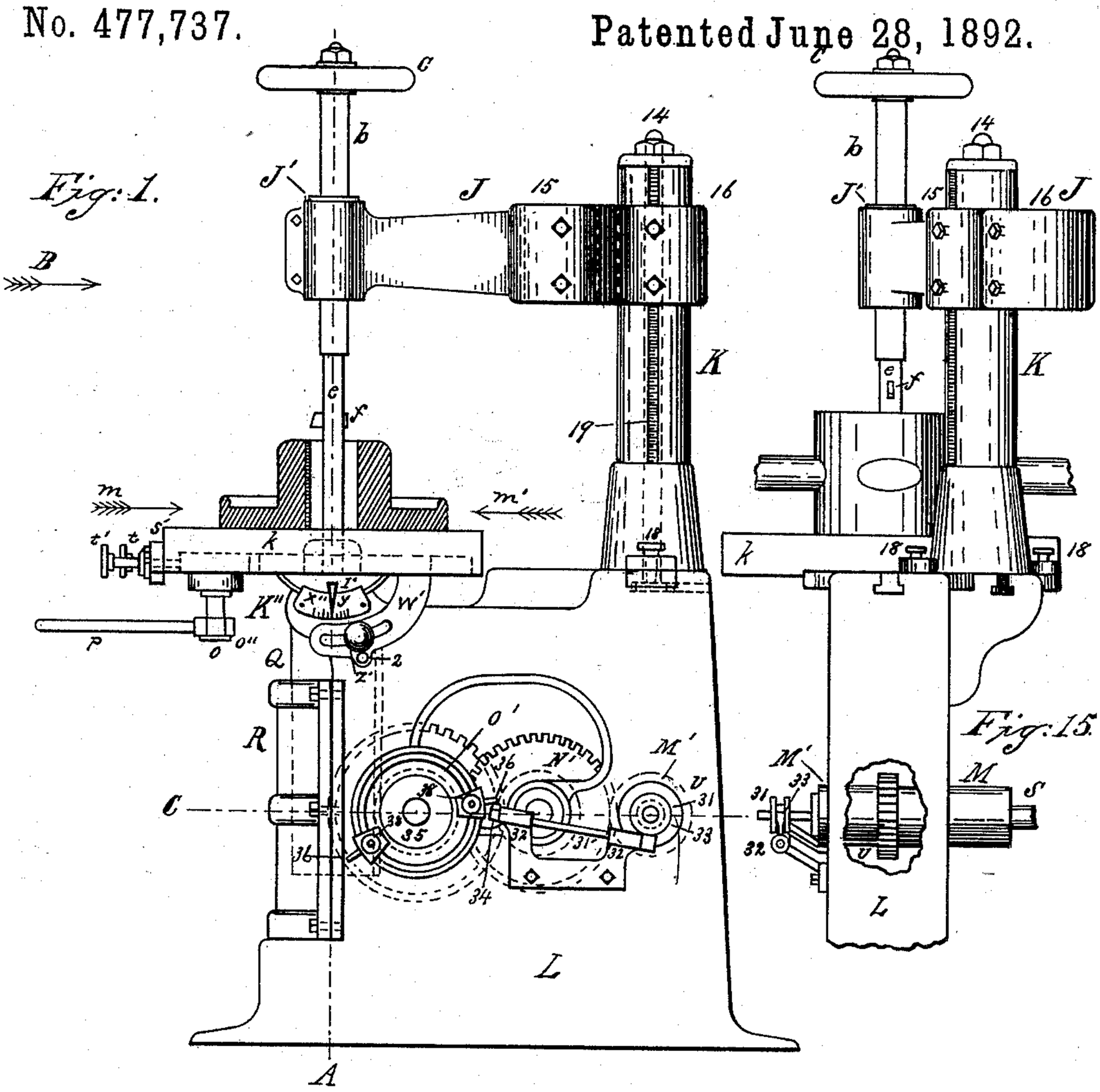


Fig. 15.

Fig. 6.

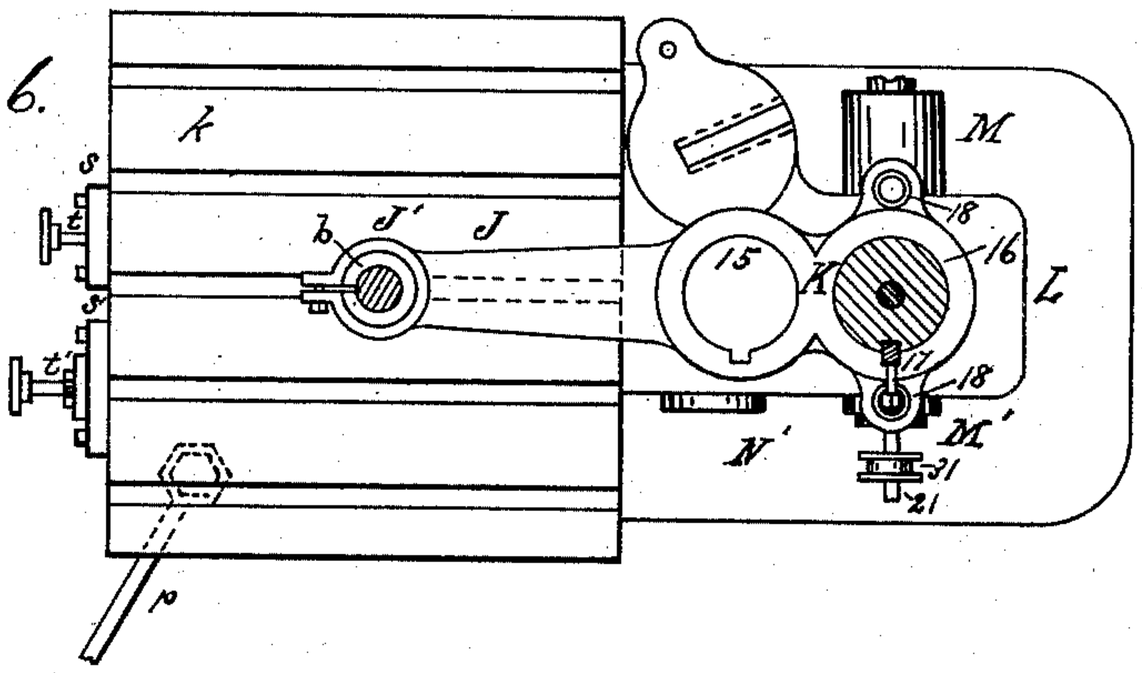
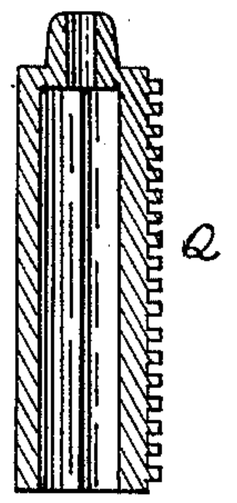


Fig. 26.



WITNESSES:

Harry M. Chilcote.

John A. Beat.

INVENTOR

Leslie H. Colburn.

(No Model.) 4 Sheets—Sheet 2.

L. H. COLBURN.

SLOTTING MACHINE.

No. 477,737. Patented June 28, 1892.

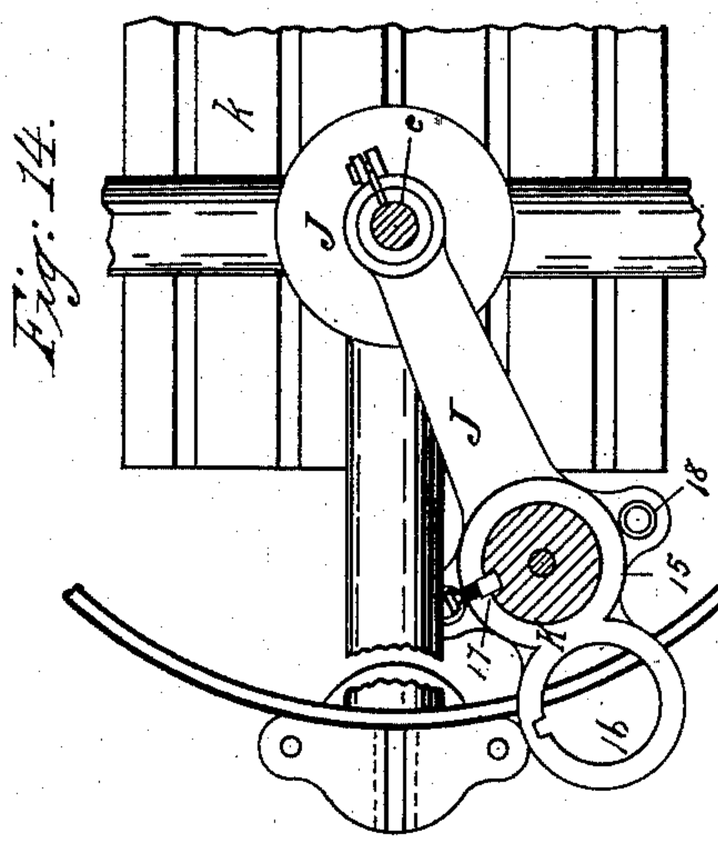


Fig. 1.

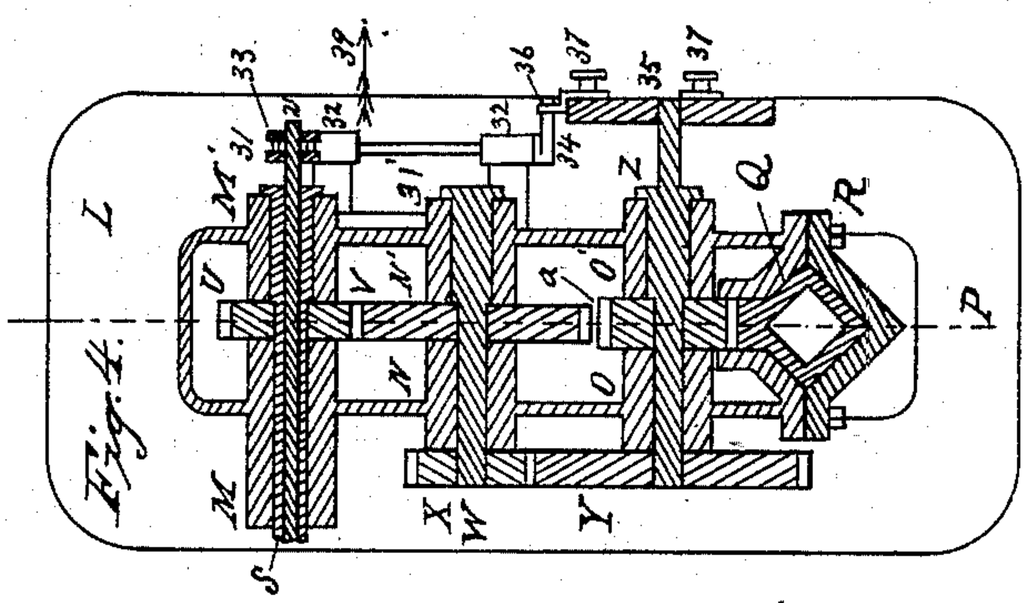


Fig. 4.

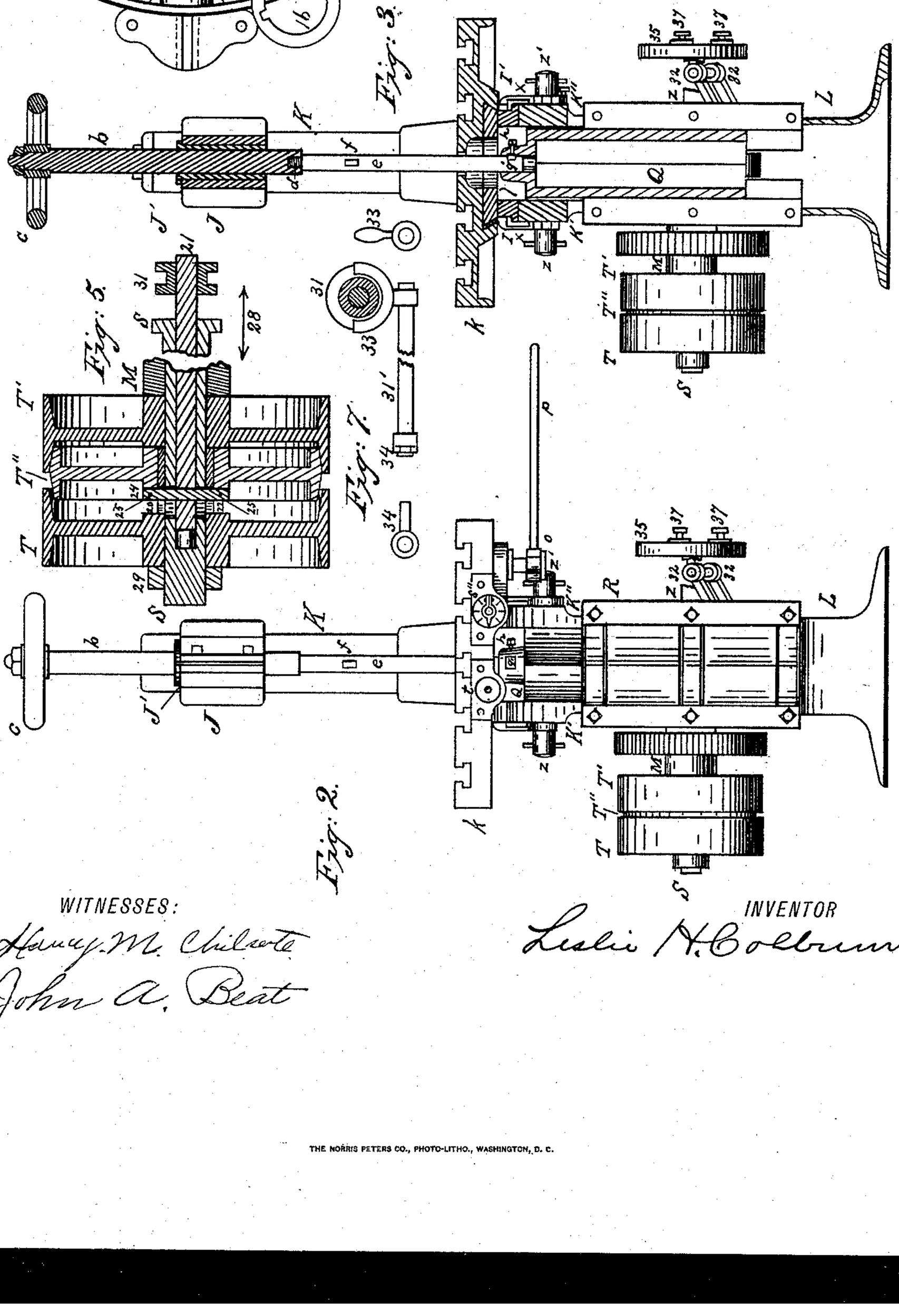


Fig. 2.

Fig. 5.

Fig. 7.

Fig. 3.

WITNESSES:

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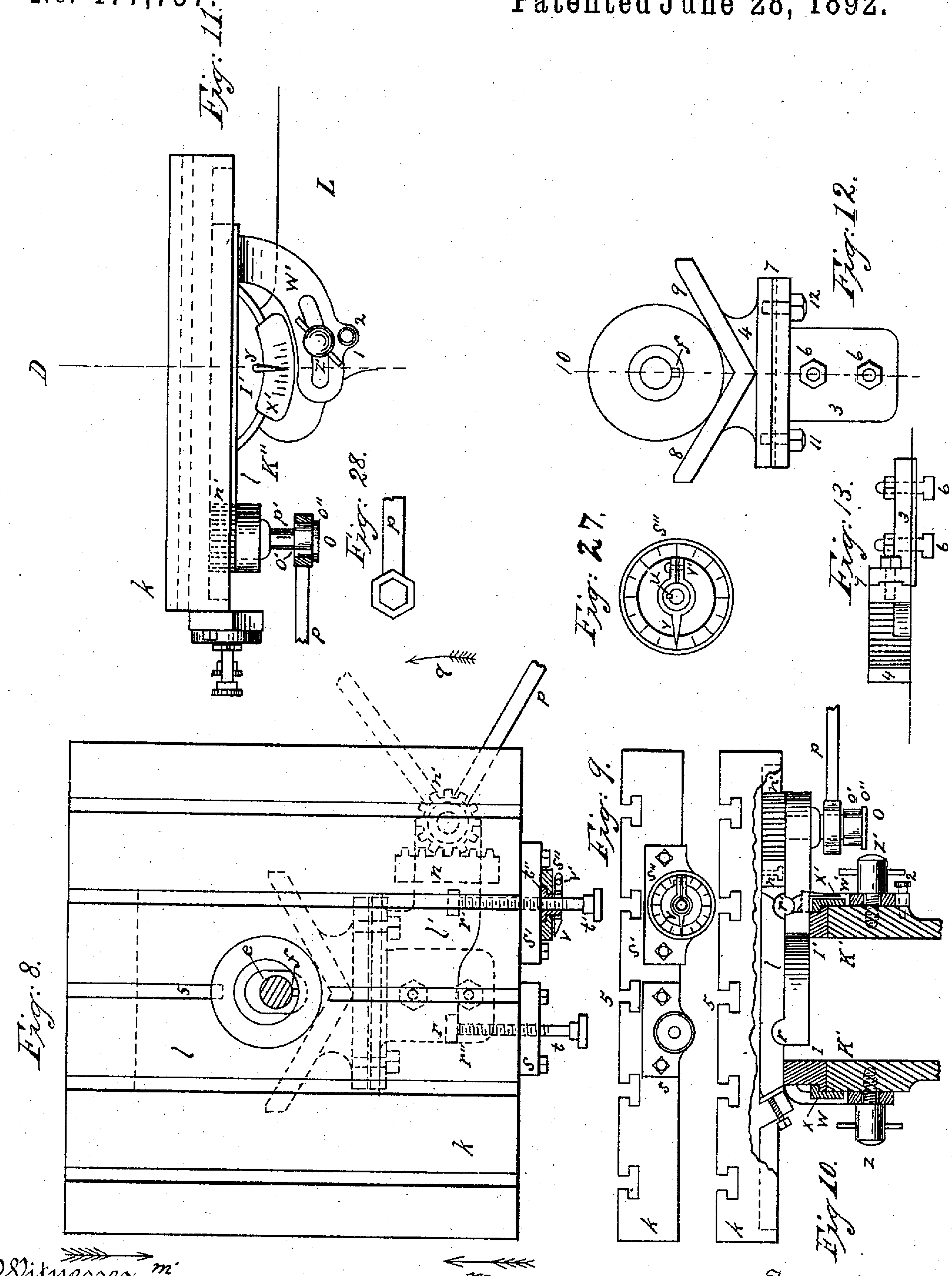
4 Sheets—Sheet 3.

L. H. COLBURN.

SLOTTING MACHINE.

No. 477,737.

Patented June 28, 1892.



Witnesses

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

L. H. COLBURN.

SLOTTING MACHINE.

No. 477,737. Patented June 28, 1892.

Fig: 20

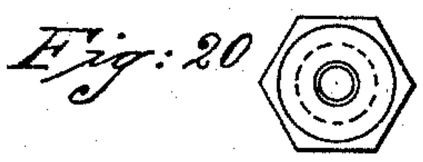


Fig: 19.

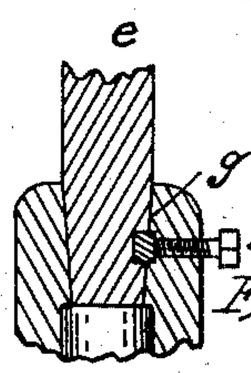


Fig: 17.

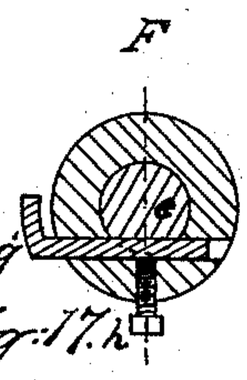


Fig: 16.

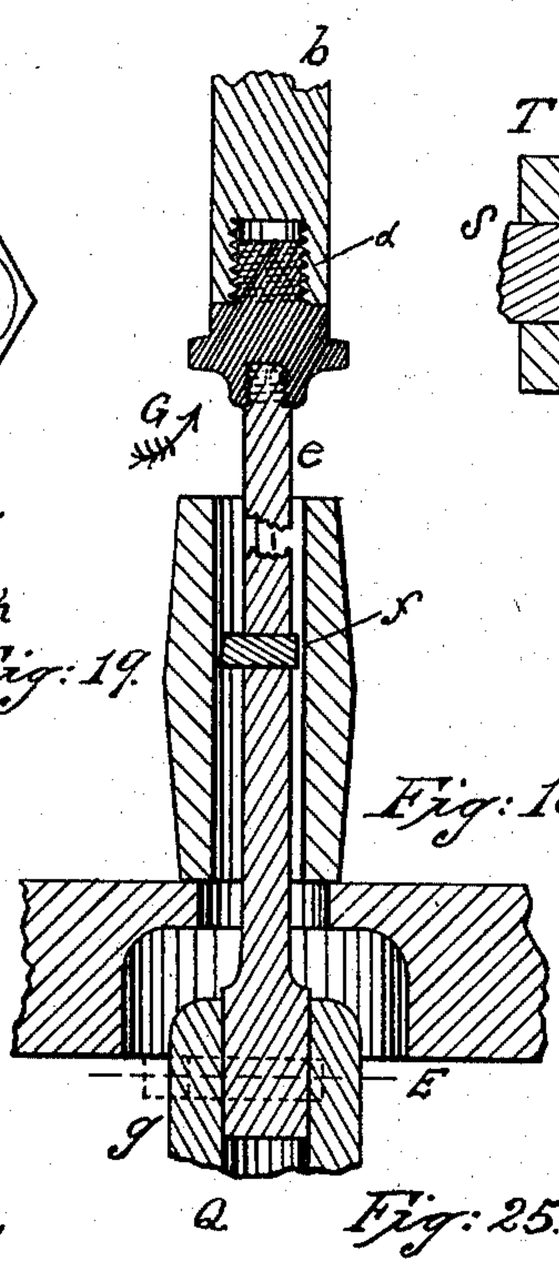


Fig: 18

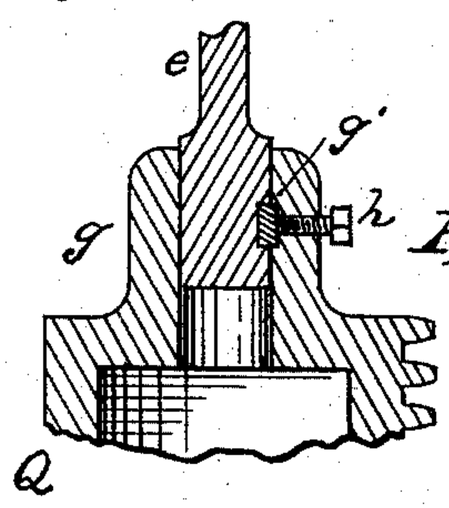


Fig: 21.

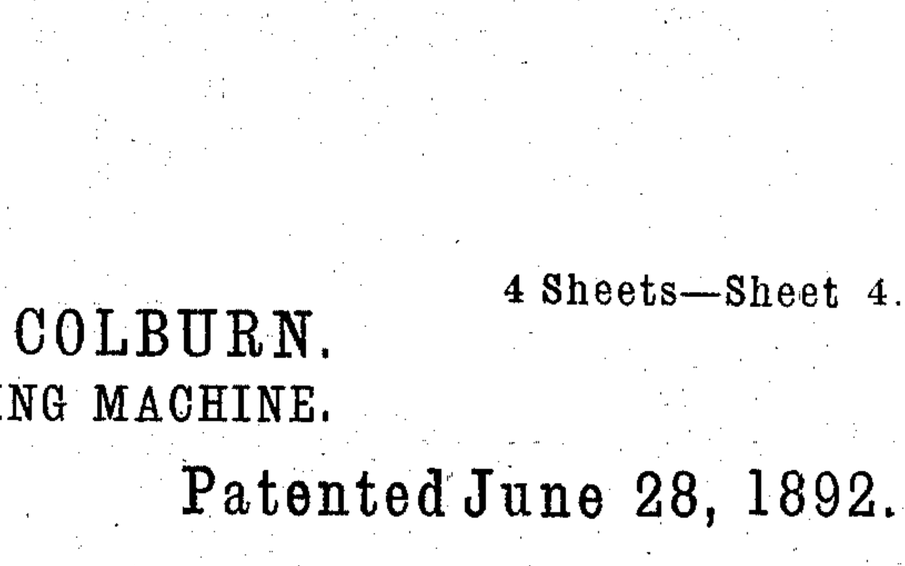


Fig: 22.

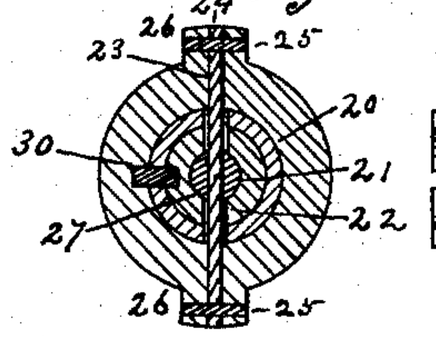


Fig: 23.

Fig: 25.

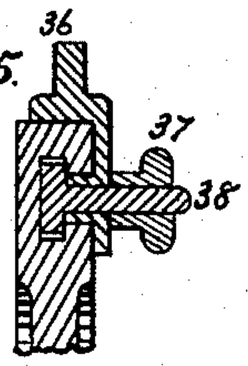
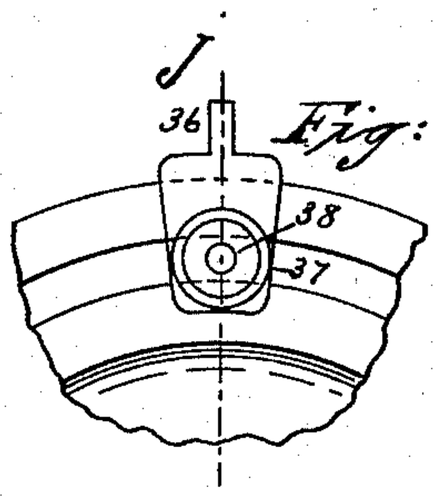


Fig: 24.



Witnesses
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Inventor
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UNITED STATES PATENT OFFICE.

LESLIE H. COLBURN, OF TOLEDO, OHIO.

SLOTTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 477,737, dated June 28, 1892.

Application filed May 27, 1891. Serial No. 394,300. (No model.)

To all whom it may concern:

Be it known that I, LESLIE H. COLBURN, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Slotting-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in slotting-machines which have a vertically-operating reciprocating cutter for making the slot.

The objects of my invention are, first, to afford facilities for making a perfectly-straight cut in the metal to be operated upon, and this is accomplished by affording improved facilities for supporting the cutter-bar; second, to construct a machine that can be used on articles having a great range in their external diameters, and upon articles such as pulleys and gearing, where their arms and rims are in the way of connecting mechanism for supporting the opposite extremities of the cutter-bar; third, to provide improved mechanism for regulating the length, depth, and taper of the cut to be taken; fourth, to provide a device for radially locating the slot in the bore of the work to be operated upon. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the entire machine. Fig. 2 is a front elevation of the machine. Fig. 3 is a vertical section of the machine on line A, Fig. 1, viewed in the direction of the arrow B. Fig. 4 is a cross-section on line C, Fig. 1, showing the manner of gearing this machine. Fig. 5 is an enlarged section of the driving and friction pulleys and a portion of the mechanism for operating the same. Fig. 6 is a plan. Fig. 7 (in four parts) represents side views of portions of the reversing mechanism. Fig. 8 is an enlarged view of the top of the table, showing the feed mechanism. Fig. 9 is an enlarged view of the front of the table. Fig. 10 is an enlarged view of the front of the table, showing the mechanism underneath in section on line D, Fig. 11. Fig. 11 is an enlarged side view of the table, showing the mechanism for tilting the same. Fig. 12 is an enlarged top view of the centering or radially-locating device. Fig. 13 is an enlarged side view of the same. Fig. 14 is a plan of my improved arm, showing its position on the machine when cutting a pulley of such a diameter and with its key-seat in such a position as that its rim or one of its arms would occupy the normal position of the connecting mechanism of the upper and lower extremities of the cutter-bar. Fig. 15 is a rear elevation of a portion of the machine, showing the arm in the position illustrated in Fig. 14. Fig. 16 is an enlarged sectional view of the cutter-bar, showing the manner of fastening it to the upper guide-bar at its upper extremity and to the lower guide-bar at its lower extremity. Fig. 17 is an enlarged cross-section of the cutter-bar and lower guide-bar on line E, Fig. 16. Fig. 18 is an enlarged vertical section of a portion of the lower guide-bar and part of the cutter-bar on line F, Fig. 17. Fig. 19 is an enlarged section same view as Fig. 18, showing the cutter-bar as tapered at the bottom. Fig. 20 is an enlarged view of the reducing-socket viewed in direction of arrow G, Fig. 16. Fig. 21 is an enlarged sectional view of the central portion of the mechanism shown in Fig. 5. Fig. 22 is an enlarged cross-section on line H, Fig. 21. Fig. 23 is an enlarged section of the sleeve. Fig. 24 is an enlarged view of the dog and part of the disk shown in Fig. 1. Fig. 25 is an enlarged section on line *j*, Fig. 24. Fig. 26 is a section of the lower guide-bar on line P, Fig. 4. Fig. 27 is an enlarged front view of the micrometer or index-plate. Fig. 28 is a plan of an operating-wrench.

Similar letters and figures refer to similar parts throughout the several views.

The arm J, column K, and standard L constitute the frame-work of the machine. The lower guide-bar Q has a vertical movement in a bearing, preferably V-shaped, in the front of the standard L, as shown in Fig. 4. The bearing being V-shaped, the wear is readily taken up by tightening the screws on the cap R. The lower guide-bar is actuated by a train of gearing, as shown in Fig. 4. The shaft S, journaled in the bearings M and M′, carries on its outer left-hand end a set of fric-

tion-pulleys T T′ T″. By means of an open and a crossed belt and mechanism hereinafter described a rotary motion is given to the shaft S in either direction. On the shaft S is keyed a pinion U, the teeth of which engage with the large gear V, keyed to the shaft W, journaled in the bearings N and N′. To the outer left-hand end of the shaft W is keyed another pinion X, which engages with the large gear Y, keyed to the shaft Z, journaled in the bearings O and O′. To this shaft Z is keyed another pinion *a*, the teeth of which engage with the teeth in the rack of the lower guide-bar Q. Thus it is obvious that a large amount of power may be readily transmitted to the aforesaid guide-bar Q.

On the front end of the arm J is an adjustable bearing, into which the upper guide-bar *b* is fitted. At the upper extremity of the said upper guide-bar *b* is a hand-wheel C. At its lower extremity this bar is bored and threaded, as shown at *d*, Figs. 3 and 16. A bar *e*, carrying a suitable cutter *f*, having at its upper extremity a thread, is adapted to fit into the opening *d*. The lower end of the bar is fitted to the upper end of the lower guide-bar Q, thus bringing shaft *b*, cutter-bar *e*, and lower guide-bar Q into line with each other. The cutter-bar is secured to the lower guide-bar in the manner illustrated in Figs. 16, 17, 18, and 19. The lower guide-bar Q has a projection *g*, in which a hole is bored, either straight or tapered, whose axis is exactly in line with the center of the V-shaped bearing in the standard L and the center of the bearing J′ in the arm J. The lower end of the cutter-bar is fitted to this bore in the lower guide-bar and a slot cut through both parts thus fitted together, as illustrated in the sectional view, Fig. 17. The key *g′*, having preferably the outer end bent, as shown in Fig. 17, is fitted into this slot. The set-screw *h* is tightened against the key *g′* to prevent its jarring loose while the machine is working. The thrust upward and the pull of the cut downward can be carried now, and the cutter-bar *e* cannot be disconnected until the key *g′* is withdrawn.

The two upper outwardly-projecting sides K′ and K″ of the standard L are accurately bored as a bearing for the rockers I and I′. These rockers are segments of a circle whose vertical center lies in the plane of the top of the table *k* and in line with the vertical center of the cutter-bar *e*. These rockers are attached by suitable means to the slide *l*. To this slide *l* is fitted the table *k*, which is adapted to slide in a direction corresponding to either of the arrows *m* or *m′*, Fig. 1. The mechanism for accomplishing this purpose and for regulating the amount of movement to be given the table is as follows: To the under side of the table *k* is fastened the rack *n*. To a projection *l′* of the slide *l* is fastened a stud *o*, having at its upper extremity and securely fastened to it a pinion *n′*, engaging with the teeth of the rack *n*. At the lower extremity of the stud *o* is a polygonal head *o′*. A wrench *p*, adapted to fit the head *o′*, having a rather long handle, is passed over the head of the stud *o*, and the lower cap or flange *o″* secured to the head *o′*, thus preventing the wrench *p* from falling off when allowed to rest in the position shown in Fig. 11. Having drawn the wrench into the position shown in Fig. 8, by raising it to the position shown in Fig. 10, and thrusting it back in the direction of the arrow *q* to the position shown by the dotted lines, Fig. 8, and dropping it on the head *o′* again, it is now ready to be again drawn forward to its former position.

It is obvious that the stud, moving in a rigid bearing in a projection of the slide *l*, having firmly secured to it a pinion whose teeth engage with the rack *n*, having motion given to it by means of the wrench *p*, as aforesaid, will, through the mechanism hereinbefore described, convert motion to the table to which the material is secured.

The material to be operated upon being fastened to the table *k* by suitable means, the machine is put in motion. By moving the handle of the wrench *p* toward the front of the machine the work is brought in contact with the cutter *f* in the vertically-moving bar *e*. On the projection *l′* of the slide *l* are two lugs *r* and *r′*. On the front of the table are two ears *s* and *s′*, either a part of said table or fastened thereto. A screw *t* is threaded into ear *s* in line with the lug *r*. The depth of the cut to be taken at each stroke is gaged by turning the screw *t* outwardly away from the lug *r*, the distance from the lug *r* to the end of the screw at *r″* being the depth of the cut. Another screw *t′* is threaded into the ear *s′* and projects through to the lug *r′* on the projection *o* of the slide *l*. Firmly fastened to the ear *s′* is a graduated plate *s″*. Into a recess of the plate *s″* is fitted a sleeve *t″*, held in position by a flange at its inner end. The sleeve *t″* is fastened to the screw *t′* by means of a key *u*, fitted loosely in the shaft and tightly in the sleeve. To the part of the sleeve *t″* extending outside of the plate *s″* is fitted a pointer or index-finger *v*, adapted to be clamped in position on sleeve *t″* by means of a screw *v′*. To regulate the depth of the slot to be cut in the work, the screw *t′* is first screwed in until its end contacts with the lug *r′*, the work on the table having first been brought in contact with the cutter *f* in the cutter-bar *e*. The index-finger *v* is then turned around on the shaft *t″* to the zero-mark on the graduated plate *s″* and clamped in position by means of the screw *v′*. The screw *t′* is then turned outwardly the requisite number of turns, each turn corresponding to a fraction of an inch and being indicated by the index-finger on the graduated plate. The screw is then allowed to remain in its position, the work being fed in at each stroke by the other screw *t* until the end of the screw *t′* again contacts with the lug *r′*, when the slot has been cut its required depth.

To the under part of the slide *l*, at both sides, are fastened the quadrants *w* and *w'*. Two cars *x* and *x'*, fastened to the standard L, overlap flanges on the rockers I and I', thus holding them firmly to their bearings in the standard. By means of this mechanism the table can be tilted in either direction. The amount of slant or the degree of the taper to be cut can be determined by the pointer secured to the rocker I' and moving over the graduated arc on X'. The desired angle being obtained, the table is held in position by clamping the quadrants to the standard by means of the screws *z* and *z'*. On the quadrant *w'* is an ear or lug 1. While the table is in a horizontal position, a taper hole is bored through this lug 1 into the standard L and fitted with a pin 2. When it is desired to quickly bring the table from a tilted to a horizontal position, the screws *z* and *z'* are loosened and the table allowed to move in its bearings K' and K'' until the pin 2 can be inserted into its original bearing. For radially locating the slot in the bore of the work a device (illustrated in Figs. 12 and 13) is used. The plate 3 has on its lower face a tongue, which fits into the lateral T-slot 5 of the table *k* and held in position by the bolts *b b*. To the perpendicular surface of this plate, at right angles to the tongue at 7, is fitted by a tongue and groove the plate 4. This plate has two sides 8 and 9, forming any desired angle, which sides each form the same angle to a line 10, passing through the center of the cutter *f* to the point of intersection of the sides 8 and 9—that is, the angle 8 10 must equal the angle 9 10. To bring the plate 4 into the position illustrated, an adjustment is made by the bolts 11 12. The article can then be placed so that the surfaces 8 and 9 will come in contact with its external diameter, thus radially locating the slot when cut in the bore of the same. This device, when clamped to the table, also tends to keep the work from being moved away from the cutter when in motion.

When articles such as pulleys are of such a diameter that their rims or spokes would contact with the column K when in its normal position, the means illustrated in Figs. 6, 14, and 16 are used to overcome the difficulty. The column K is fastened to the standard L by means of the bolt 14, passing through its entire length into the T-slot in standard L and tightened at the top by a nut. The arm J has two bearings 15 and 16, adapted to fit the outside of the column K, and adapted to be vertically adjusted thereon for different lengths of work and varying lengths of movements, the latter conforming with the movements of the lower guide-bar, as hereinafter described. The key 17, Fig. 6, serves the purpose of keeping the bearing J' in line with the cutter-bar *e* and the lower guide-bar Q. When a piece of work such as a pulley is to be slotted, whose arms or rim interfere with the column K, the bolt 14 is loosened and the column K placed in the position shown in Fig. 14. The arm J is placed upon the column which enters the bearing 15 of the arm. The alignment of the bearing J' is obtained by the key 17, secured in the same manner as illustrated in Fig. 6. A pulley whose rim or arms would interfere with the column in the former position can now be placed upon the table and the mechanism for supporting the cutter-bar placed in position without interfering with either arms or rim. It is obvious that pulleys of any diameter can be slotted in this manner and the slot cut in line with one of its arms or in any other position desired, and with the two combinations illustrated contact of the column K with either the rim or spokes is avoided. The column, in addition to the bolt 14, is firmly held in position by the taper pins 18 18, which operate, in conjunction with key 17 in the slot 19 of the column, to bring the bearing J' into line with the cutter-bar *e*.

The device for shifting the machine is as follows: On the outer left-hand end of the shaft S are two pulleys T and T', loosely fitting the shaft, one driven by an open, the other by a crossed, belt. Between them is fitted a sleeve 20, which keeps them the proper distance apart and prevents them from coming together. Fitted on the outside surface of this sleeve is loosely fitted another pulley T'', whose outside rim is crowning or tapered both sides from the center. The taper rim of one side fits the inside taper of the rim of pulley T'. The shaft S is bored hollow, and another shaft 21 is fitted so as to move freely inside of it. The shaft S and sleeve 20 are slotted at 22. The hub of pulley T'' is slotted, as shown at 23, and a pin 24 fitted into it and held in position in the hub by two pins 25 25, passing through projections 26 26 of the hub. The pin 24 fits snugly into the shaft 21, as shown at 27, and is free to move in the slot 22 of the shaft S and sleeve 20. By moving the shaft 21 in either direction (shown by the double-headed arrow 28) the pulley T'' is carried along with it until it contacts with one of the pulleys T or T', which are running in opposite directions. Motion is thus converted in either direction to the pulley T'', the thrust against the pulleys T and T' being taken up by the collar 29 on one end of the shaft S and the bearing M. A key 30, Fig. 22, running the whole length of and passing through the sleeve 20, locks the pulley T'' and shaft S together and keeps the pulley T'' from rotating without turning shaft S with it, but does not interfere with its longitudinal motion on the sleeve. The sleeve 20 keeps the pulleys T and T' from being drawn together when the pulley T'' is drawn or thrust away from either of them. On the outer end of the shaft 21 is a collar 31, having a deep groove in its periphery. Another shaft 31' is secured in bearings 32 32 and rests at right angles to shaft 21, to one end of which is fastened a forked projection 33, the arms or fingers of which are

adapted to fit loosely in the groove of the collar 31. At the other end of the shaft is a projection or dog 34. To the outer right-hand end of the shaft Z is fastened a circular plate or disk 35, having a circular T-slot on its outer face, near its circumference, to which is secured two tappets 36 36, having outward projections and held in position by means of the nuts 37 37 and bolts 38 38. By loosening the hand-nuts 37 37 the tappets can be adjusted in any position desired on the disk, thus gaging the length of the movement of the lower guide-bar. The machine being set in motion and having, say, an upward stroke, the disk revolves, carrying the tappets 36 and 36 with it until one of them comes into contact with the dog 34 on the shaft 31′. This throws the dog 34 downward, carrying the forked projection 33 with it, in the direction of the arrow 39, Fig. 4. This fork 33, by means of the collar 31 and shaft 21, carries with it the pulley T″, drawing it from its contact with pulley T into contact with pulley T′. Pulley T′ is running in an opposite direction from that of T. Thus the mechanism is reversed, the cutter-bar *e* now having a downward motion until the other tappet 36 comes into contact with the dog 33, when the pulley T″ is thrust back again against T.

I am aware that prior to my invention slotting-machines have been made with vertically-reciprocating cutter-bars operating in conjunction with a table carrying the work to be operated upon. I therefore do not claim such a combination broadly; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. In a slotting-machine, a horizontally-moving table adapted to rigidly hold articles to be operated upon by a vertically-moving cutter-bar and a vertically-moving lower guide-bar adapted to be secured to the lower extremity of said cutter-bar by means of a key passing through the upper extremity of the said guide-bar and impinging upon a flattened side of said cutter-bar.

2. In a slotting machine, a horizontally-moving table adapted to rigidly hold articles to be operated upon by a vertically-moving cutter-bar, a vertically-moving lower guide-bar adapted to be secured to the lower extremity of said cutter-bar and adapted to operate through means of the said cutter-bar, and an upper guide-bar secured to the extremity of the said cutter-bar by means of a screw upon the upper extremity of said cutter-bar threaded in the lower extremity of said upper guide-bar.

3. In a slotting-machine, a horizontally-moving table adapted to rigidly hold articles to be operated upon by a vertically-moving cutter-bar, a vertically-moving lower guide-bar adapted to be secured to the lower extremity of said cutter-bar by means of a key passing through the upper extremity of said guide-bar and impinging upon a flattened side of said cutter-bar and adapted to operate through means of the said cutter-bar, and an upper guide-bar secured to the upper extremity of the said cutter-bar by means of a screw upon the upper extremity of said cutter-bar threaded in the lower extremity of said upper guide-bar, the said guide-bars being secured in suitable guideways and thereby unitedly adapted to guide in a substantially true line the said cutter and cutter-bar, substantially as shown.

4. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be vertically adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

5. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be radially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

6. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be circumferentially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

7. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be vertically and radially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

8. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be vertically and circum-

ferentially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

9. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be radially and circumferentially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

10. In a slotting-machine, a horizontally-moving table and a cutter-bar adapted to be moved in angular positions therewith and secured at its upper and lower extremities to correspondingly-moving guide-bars operating in fixed bearings located in the common frame of the mechanism, the bearings in which the upper guide-bar moves being secured to an upper extension of said frame, which extension is adapted to be vertically, radially, and circumferentially adjusted with respect to the vertical center of said cutter-bar, substantially as shown.

11. In a slotting-machine, a vertically-moving cutter-bar, a table adapted to be moved toward and from the vertical center thereof, a centering-rest superimposed upon said table and consisting of an angular face-piece adapted to be moved upon the plane of the surface of said table toward and from the vertical center of said cutter-bar, and a face-plate having angular wings, either acute or obtuse to each other, attached to the said angular face-piece and adapted to be adjusted transversely of the plane of the vertical center of said cutter-bar and with the said angular piece to adjust toward and from the said vertical center of said cutter-bar, substantially as shown.

12. In a slotting-machine, a reciprocating cutter-bar and a table adapted to be alternatingly adjusted thereto, the said alternating adjustments on the said table being controlled in their extent by a screw, in combination with a second screw adapted to gage at one setting the entire desired extent of the movement of said table and the sum of the alternating adjustments of the said first micrometer-screw, substantially as shown.

13. In a slotting-machine, a reciprocating cutter-bar and a table adapted to be alternatingly adjusted thereto, the said alternating adjustments on the said table being controlled in their extent by a screw, in combination with a second screw, and a graduated dial and pointer adapted to gage at one setting the entire desired depth of the movement of said table and the sum of the alternating adjustments of the said first micrometer-screw, substantially as shown.

14. In a slotting-machine, a vertically-moving cutter-bar, and a table adapted to be adjusted thereto by means of a rack and pinion, the pinion being adapted to be operated by means of a reciprocating wrench irremovably attached to an extension of said gear and adapted to engage a nut thereto, substantially as shown.

15. In a slotting-machine, a supporting-table adapted to rigidly hold articles to be operated upon by a vertically-moving cutter-bar, in combination with vertically-moving and vertically-adjusting lower and upper guide-bars, and an upper supporting-arm, the said upper supporting-arm being adapted to be vertically adjusted to correspond with the varying adjustments of the said guide-bars, substantially as shown.

In testimony whereof I affix my signature in presence of two witnesses.

LESLIE H. COLBURN.

Witnesses:
A. E. BAKER,
GEO. L. COLBURN.