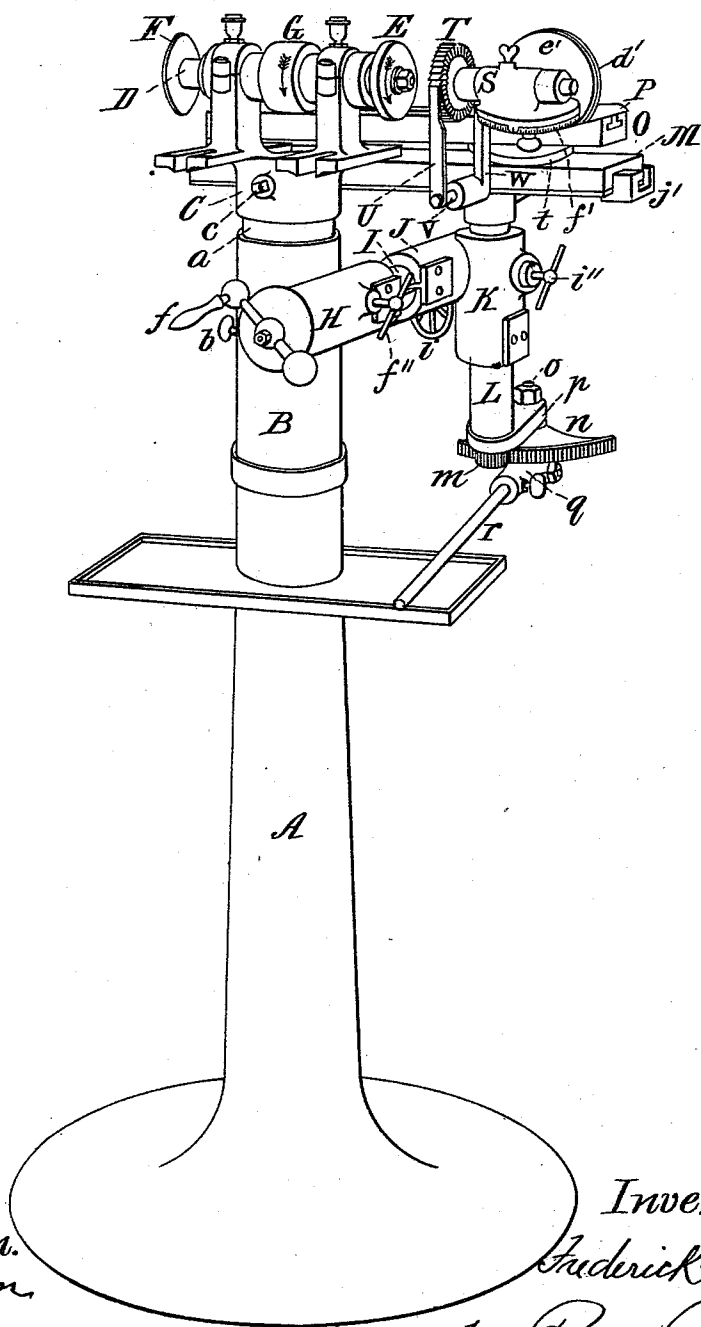


5 Sheets—Sheet 1.

No. 439,154.

Patented Oct. 28, 1890.

Fig.1.



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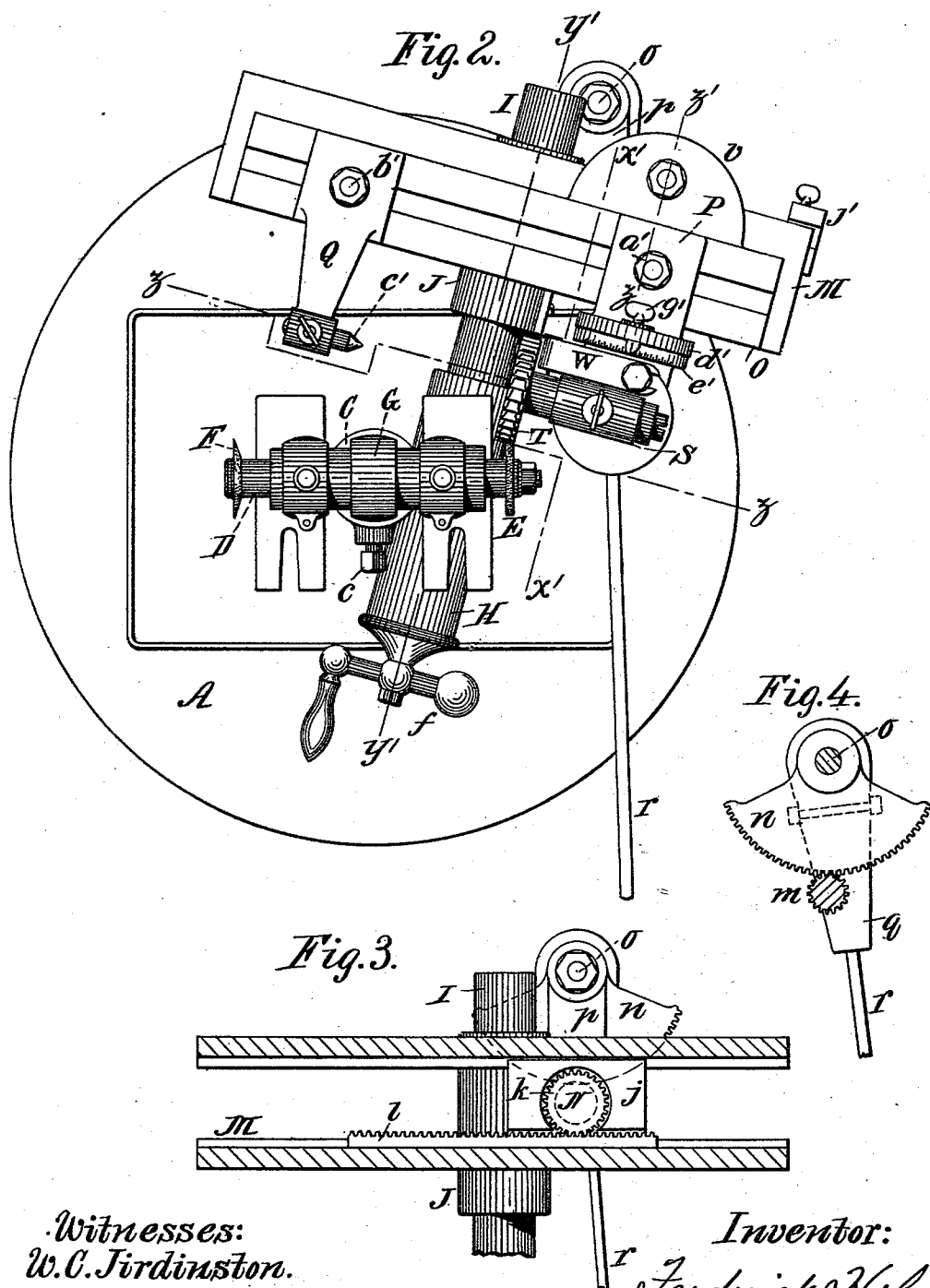
(No Model.)

5 Sheets—Sheet 2.

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CUTTER GRINDER.

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5 Sheets—Sheet 3.

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Fig.5.

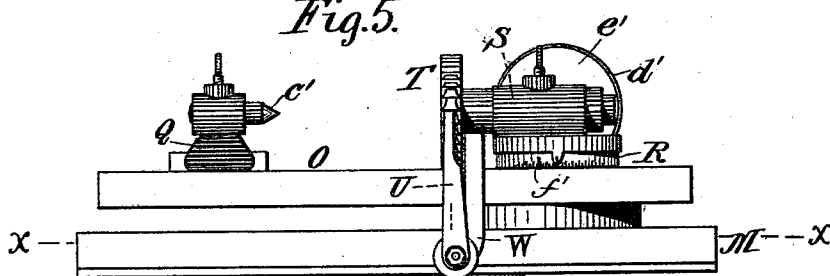


Fig. 6. g^d

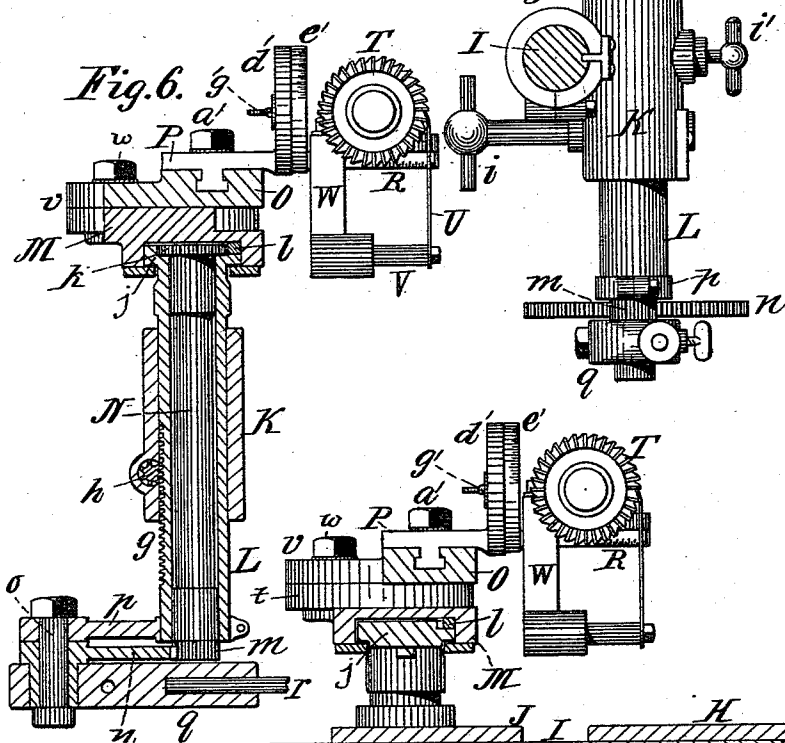
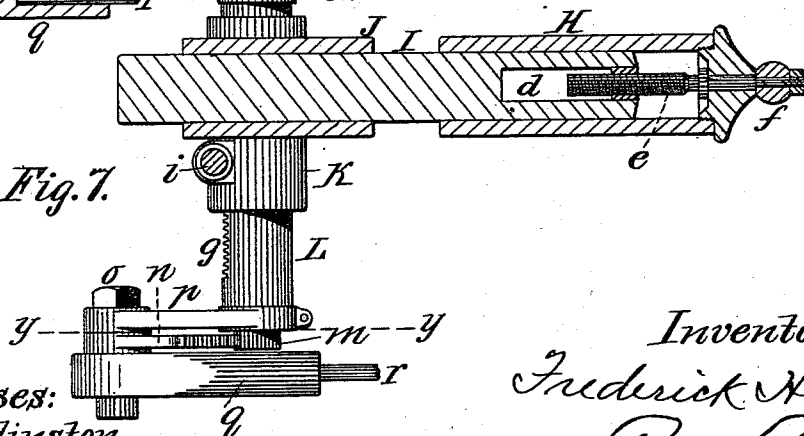


Fig. 7.



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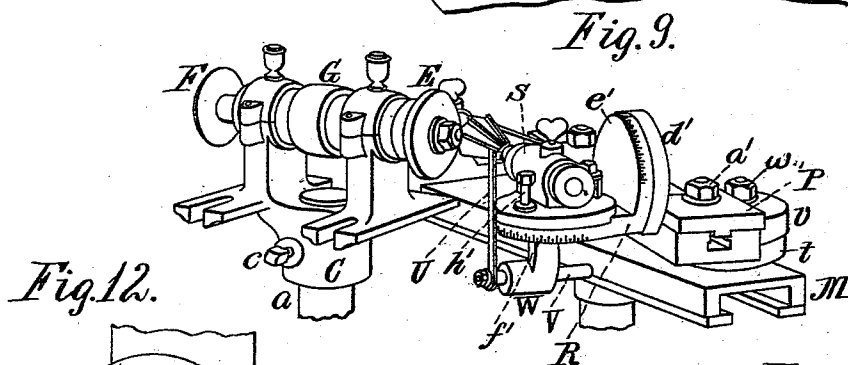
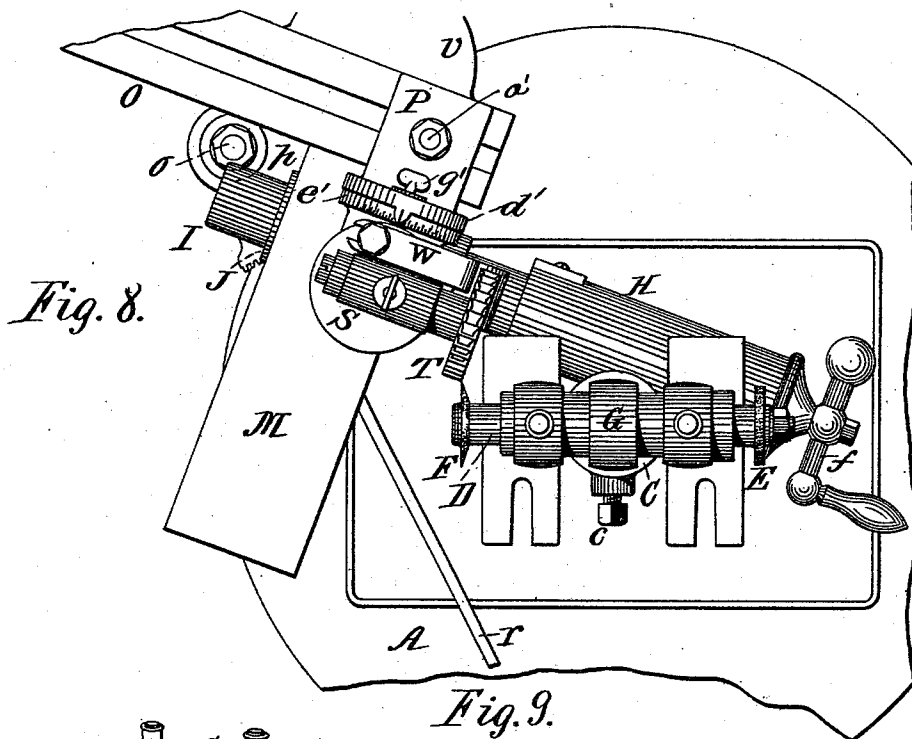


Fig. 12.

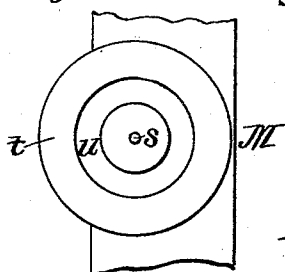


Fig. 10.

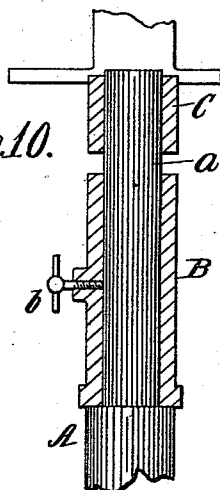
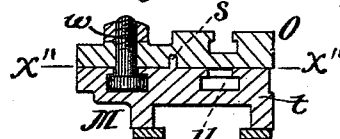


Fig. 11.



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(No Model.)

5 Sheets—Sheet 5.

F. HOLZ.
CUTTER GRINDER.

No. 439,154.

Patented Oct. 28, 1890.

Fig. 13.

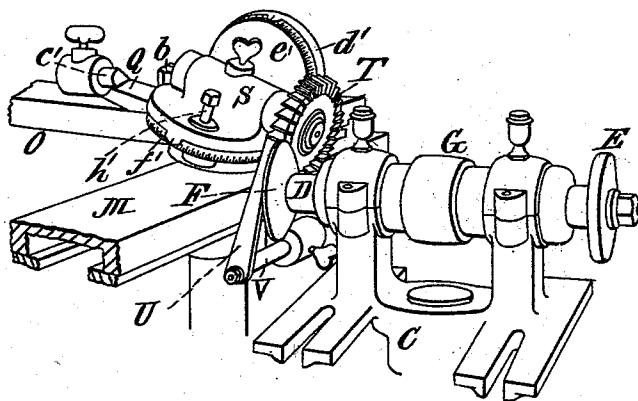


Fig. 15.

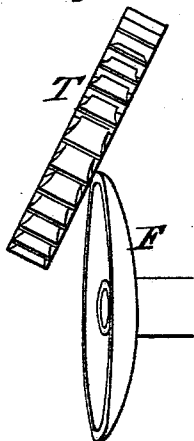
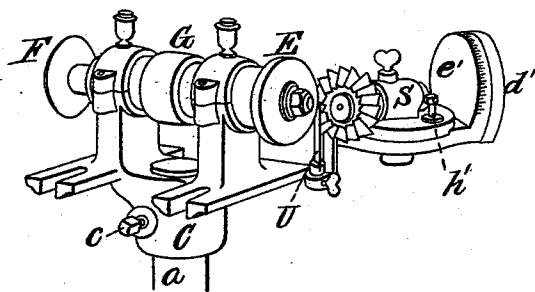


Fig. 14.



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UNITED STATES PATENT OFFICE.

FREDERICK HOLZ, OF CINCINNATI, OHIO, ASSIGNOR TO THE CINCINNATI MILLING MACHINE COMPANY, OF SAME PLACE.

CUTTER-GRINDER.

SPECIFICATION forming part of Letters Patent No. 439,154, dated October 28, 1890.

Application filed November 2, 1889. Serial No. 328,992. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HOLZ, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Cutter-Grinders, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to a universal cutter and reamer grinder for grinding milling cutters and reamers of all shapes, such as face-mills, angular cutters, end mills, spiral mills, slitting-saws, and taper and straight reamers.

It has for its object the improved construction and mode of operation of such grinders, whereby they are rendered universal, simple in construction and operation, and by which I am enabled to grind a straight-line clearance with smaller grinders than usual for this work, and in such a manner as to not heat the cutters to an injurious extent.

The novelty of my invention will be hereinafter set forth, and specifically pointed out in the claims.

In the accompanying drawings, Figure 1, Sheet 1, is a perspective elevation of a cutter-grinder embodying my invention. Fig. 2, Sheet 2, is an enlarged plan view of the machine adjusted for grinding the top teeth of a cutter. Fig. 3, Sheet 2, is a detail section in plan through the dotted line $x x$ of Fig. 5. Fig. 4, Sheet 2, is a detail in plan through the dotted line $y y$ of Fig. 7. Fig. 5, Sheet 3, is a sectional detail in elevation through the dotted line $z z$ of Fig. 2. Fig. 6, Sheet 3, is a sectional detail through the dotted line $x' x'$ of Fig. 2, looking to the right. Fig. 7, Sheet 3, is a sectional detail in elevation through the dotted line $y' y'$ of Fig. 2, looking to the right. Fig. 8, Sheet 4, is a plan view of the machine adjusted for grinding the side teeth of a cutter. Fig. 9, Sheet 4, is a perspective of the top of the machine adjusted for grinding tapering cutters or reamers. Fig. 10, Sheet 4, is a detail central section of the standard. Fig. 11, Sheet 4, is a sectional detail in elevation through the dotted line $z' z'$ of Fig. 2, looking to the right. Fig. 12, Sheet 4, is a

detail plan through the dotted line $x'' x''$ of Fig. 11. Fig. 13, Sheet 5, is a perspective of the top of the machine adjusted for grinding a straight clearance on the side teeth of a cutter. Fig. 14, Sheet 5, is a perspective view of the top of the machine adjusted for grinding an angular cutter. Fig. 15 is a detail view to illustrate the operation of grinding with the cup-shaped grinder.

The same letters of reference are used to indicate identical parts in all the figures.

A, Figs. 1 and 10, is a suitable standard, secured by a base to the floor and having a cylindrical upper part a , on which is fitted an adjustable sleeve B, clamped thereto in any of its adjusted positions by a set-screw b . Upon the upper end of the standard a is adjustably secured, by means of a set-screw c , the socketed head-block C, in which is journaled the horizontal grinder-spindle D, upon one outer end of which is secured a flat grinder-disk E and upon the opposite outer end a cup-shaped grinder-disk F. A belt (not shown) from a pulley on the shafting above, passed around the pulley G upon the spindle D, drives the latter and the grinding-disks at a high speed of revolution, and the tension of the belt upon the pulley is regulated by raising or lowering the head C upon the standard a and then clamping it in its adjusted position by the set-screw c .

Secured to or integral with the sleeve B, Figs. 1 and 7, is a horizontal sleeve H, into which is feathered in a well-known manner a rearwardly-extending cylinder I, having its end within the sleeve socketed, as at d , and interiorly threaded to engage a screw e , passed through the head of the sleeve and provided with a turning-handle f . The screw e is prevented from having longitudinal motion, and it will be seen that its turning adjusts the cylinder I by sliding it without turning in the sleeve H, and after adjustments said cylinder is locked by the set-screw f'' . Upon the rear end of the cylinder I is feathered a socket-piece J, carrying upon one side a vertical sleeve K, in which is fitted and feathered a tubular vertical post L, provided on one side with a rack g , Figs. 6 and 7, with which a pinion h , journaled in the sleeve K and pro-

vided with a turning-handle *i*, Fig. 5, engages to raise or lower the post L. This post, when adjusted, is locked by the set-screw *i'*. Upon the rectangular top *j* of the post L, Fig. 3, is fitted a horizontal bed-plate M, T-grooved on its under side to engage with said top *j*, as seen in Figs. 6 and 7.

Extending up through the post L and journaled therein is a spindle N, Figs. 3 and 6, upon the upper end of which is secured a pinion *k*, recessed in the top *j* and engaging a rack *l* integral with or secured to the bed-plate M in its T-groove. Secured upon the lower end of the spindle N is a pinion *m*, Figs. 1, 5, 6, and 7, with which a segment-rack *n*, pivoted, as at *o*, to a bracket-arm *p*, secured to the post L, engages. Upon the lower end of a boss upon the segment-rack is adjustably clamped a split socket *q*, into which an actuating-rod *r* is removably inserted, which rod extends forward, as seen in Figs. 1 and 2. It will be seen from this construction that by grasping and vibrating the rod *r* the segment-rack *n* will cause the rotation of the spindle N, and through the medium of the pinion *k* and rack *l* will give a longitudinal reciprocation to the plate M in a horizontal plane.

Pivoted, as at *s*, Figs. 11 and 12, upon a circular boss *t* upon the bed-plate M (said boss being provided with an annular T-slot *u*) is a horizontally-adjustable bed-plate O, having a lateral circular projection *v*, Fig. 2, coincident with said boss and adjustably locked thereto by a bolt *w*, confined in the annular T-slot *u*. The upper surface of the bed O is T-slotted to permit the adjustable fastening thereto by bolts *a' b'* of the rectangular slide P and center holder Q, the latter being provided with the adjustable horizontal center *c'*, Fig. 2. The vertical portion of the slide P is a circular disk *d'*, to which is centrally pivoted a coincident disk *e'* of a rectangular piece R, whose horizontal circular portion *f'*, some distance above the bed-plate M, has centrally pivoted thereto the horizontally-socketed tool-holder S. Provision is made for locking the portions *d' e' f'* securely together in any of their adjusted positions by the set-screw *g'*, Figs. 2, 6, 7, and 8, and the tool-holder and part *f'* by the set-screw *h'*, Fig. 9. The portions *d' e' f'* and the circular base of the tool-holder are also graduated or indexed.

It will be seen from the above construction that the bed-plates M and O, carrying the tool-holder, can be swung around the standard A as a center by loosening the set-screw *b*. Furthermore, that said bed-plates can be moved bodily in toward or away from said standard by the screw *e*, and, again, that said bed-plates can be raised or lowered bodily by the vertical adjustment of the post L through the medium of the pinion *k* and rack *g*; also, that the bed-plate O has independent horizontal adjustment upon the bed-plate M, and, finally, that the tool-holder S has independent adjustment in a vertical plane, so as to tilt

its axis, and also in a horizontal plane. These adjustments render the machine absolutely universal for all purposes required in grinding-tools of the character named, and as illustrations of its mode of operation we will suppose that it is wished to grind the top teeth of a cutter, reference being had to Figs. 1 and 2. Here the beds M and O are coincident and the socket of the tool-holder is perfectly horizontal. The tool T is secured to the tool-holder by a shank inserted through it and the socket, and is held by a nut, leaving the tool free to be turned by hand to bring its top teeth successively to the grinder E. The sleeve B is then turned to incline the beds O M in a horizontal plane to the axis of the grinding-spindle, as seen in Fig. 2, and, finally, said beds are drawn forward by the screw *e* to bring the tooth of the tool next to the disk E and on a horizontal plane into proper grinding position, which, it will be observed, is not parallel with the face of the disk, but at an angle thereto. By now vibrating the rod *r* the beds O M are given longitudinal reciprocation on the post L, and the tooth of the tool is carried across the edge of the disk and is ground thereby without unduly heating the same, as would be the case if the tooth of the tool was presented squarely to the face of the disk.

To present the teeth successively and accurately to the edge of the disk, I provide a universally-adjustable spring-rest U, secured upon an adjustable slide V, socketed in a bracket W, adjustably secured to the tool-holder S. (See Figs. 2, 8, and 9.) The upper edge of this spring-rest acts as a spring-pawl and engages directly under the tooth being ground, and when said tooth is ground the attendant has only to turn the tool until said rest clicks under the next lower tooth and then vibrates the bar *r* to grind said tooth, and so on until all the teeth are perfectly ground and with their cutting-edges in a perfect circle. The upper edge of the rest U is in exactly the same horizontal plane with the axis of the tool-holder, and for grinding greater or less clearance to the teeth it is only necessary to lower or raise the post L, as will be readily understood. By this means no care has to be exercised in adjusting the spring-rest, as it becomes practically part of the tool-holder and moves with it. To grind the side teeth of the same cutter, it is only necessary to remove the bar *r* and to swing the bed M around to the position shown in Fig. 8 and then to swing the bed O to a position at right angles to the bed M, as in said Fig. 8, thereby bringing the side teeth to the edge of the cup-shaped grinder F. Then by reinserting the bar *r* and adjusting the tool to the disk F the operation of grinding the side teeth is proceeded with just as before described. It will be noticed that the holder *q* and segment-rack *n* are adjustable to permit this shifting of the bar *r* to either side of the standard,

and to limit the play of the bed-plate longitudinally I have provided adjustable stops on either side of the top *j* of the post L, one of which is shown at *j'*, Fig. 2, and which stops are secured in the T-groove on the under side of the bed M.

As seen in Fig. 13, when it is desired to give greater clearance in grinding the side teeth the tool-holder may be tilted, so that the horizontal planes of the tool-holder and grinding-spindle bisect each other, and this to any degree desired. Where a reamer or tool of that character is to be ground, its one end is supported on a center inserted in the tool-holder and the other end is centered on the adjustable center *c'*, carried by the slide Q, and where said tool is tapering, as seen in Fig. 9, the spring-rest U has its top edge inclined to suit the pitch of the tooth, so that in vibrating the bar *r* the attendant has only to hold the tooth in constant engagement with the spring-rest, when the tooth at all points will be properly presented to the grinding-disk.

In Fig. 14 the adjustment of the parts is shown for an angular cutter of the class used for cutting ratchet-teeth.

Among the advantages of the construction described it will be seen that the tool-holder on its bed-plates can be swung around on the standard, so that the work can be brought in contact with the grinders on each end of the spindle and at any desired angle of inclination to suit the best requirements of the tool to be ground and without injurious heating of the same as it is ground, and in most cases without disturbing its adjustment to the tool-holder. In Fig. 15 the method of inclination of the side teeth of a cutter to a cup-shaped grinder is shown, by which a large grinder can be used in cutting a straight-line clearance on one tooth without danger of contact with the other teeth.

Having thus fully described my invention, I claim—

1. In a cutter-grinder, the combination, with the grinding-spindle, of a tool-holder movable around the same and pivotally adjustable on axes in vertical and horizontal planes, substantially as and for the purpose described.

2. In a cutter-grinder, the combination, with the grinding-spindle, of a tool-holder movable in a horizontal plane around and to and from the spindle and pivotally adjustable on axes in vertical and horizontal planes, substantially as and for the purpose described.

3. In a cutter-grinder, the combination, with the supporting-standard and the grinding-spindle carried thereby, of a sleeve secured upon and movable around said standard, a bed-plate supported by said sleeve and movable to and from the grinding-spindle, and a tool-holder carried by the bed-plate and

adjustable on axes in both vertical and horizontal planes, substantially as and for the purpose described.

4. In a cutter-grinder, the combination, with the supporting-standard and the grinding-spindle carried thereby, of a sleeve secured upon and movable around said standard, a reciprocating bed-plate supported by said sleeve, a revoluble bed-plate carried by the reciprocating bed-plate, and an adjustable tool-holder carried by the revoluble bed-plate, substantially as and for the purpose described.

5. In a cutter-grinder, the combination of the following elements: a standard having upon its upper end a socket-piece, a grinding-spindle journaled in said socket, a sleeve revoluble on said standard and carrying a second horizontal sleeve, a cylinder adjustable in and out in said horizontal sleeve and carrying a vertical socket, a post vertically adjustable in said socket, a horizontal bed-plate secured to and capable of longitudinal reciprocation on said post, and a tool-holder supported by said bed-plate, substantially as described.

6. In a cutter-grinder, the combination of the following elements: a standard having upon its upper end a socket-piece, a grinding-spindle journaled in said socket, a sleeve revoluble on said standard and carrying a second horizontal sleeve, a cylinder adjustable in and out in said horizontal sleeve and carrying a vertical socket, a post vertically adjustable in said socket, a horizontal bed-plate secured to and capable of longitudinal reciprocation on said post, a second bed-plate secured to and capable of swinging in a horizontal plane on said first-named bed-plate, and a tool-holder carried by said second bed-plate, substantially as described.

7. In a cutter-grinder, the combination of the following elements: a standard having upon its upper end a socket-piece, a grinding-spindle journaled in said socket, a sleeve revoluble on said standard and carrying a second horizontal sleeve, a cylinder adjustable in and out in said horizontal sleeve and carrying a socket, a post vertically adjustable in said socket, a horizontal bed-plate secured to and capable of longitudinal reciprocation on said post, a second bed-plate secured to and capable of swinging in a horizontal plane on said first-named bed-plate, and a tool-holder carried on said second bed-plate and independently adjustable on axes in vertical and horizontal planes, substantially as described.

8. The combination, with the standard A and the tubular post L, adjustably connected therewith and vertically adjustable relative thereto, of the spindle N, having the pinions *m* and *k*, the sector *n*, gearing with the said pinion *m* and provided with an operating-handle, the plate M, provided with rack *l*, engaged by said pinion *k*, and the tool-holder

adjustably connected with the said plate M and movable relative thereto on vertical and horizontal axes.

9. The combination, with the grinder-supporting standard A, of the vertically and horizontally adjustable plate M, having a sleeve-connection with said standard and thus movable around the same and the grinder, the plate O, adjustably attached to said plate M

and carrying the slide P, having the vertical disk portion d' , the tool-holder support R, having the disk e' , pivotally attached to the said disk d' , and the tool-holder S, carried by said tool-support.

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