No. 727,981 PATENTED MAY 12, 1903.

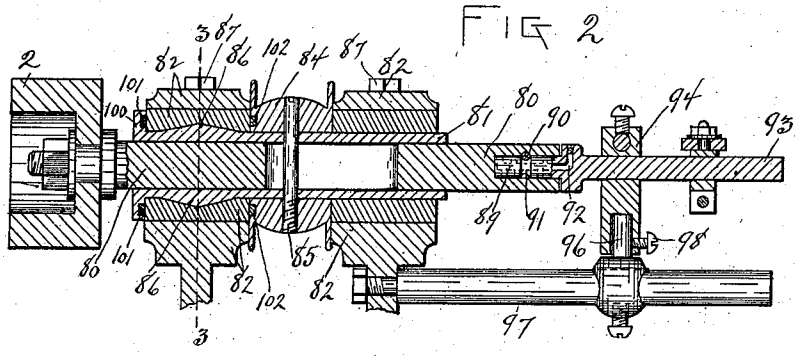
W. F. LOMASNEY.

GRINDING MACHINE.

APPLICATION FILED JAN. 6, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 2



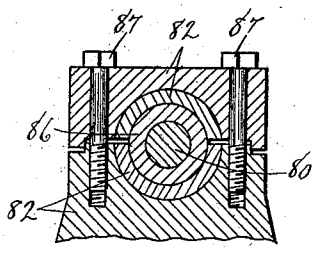
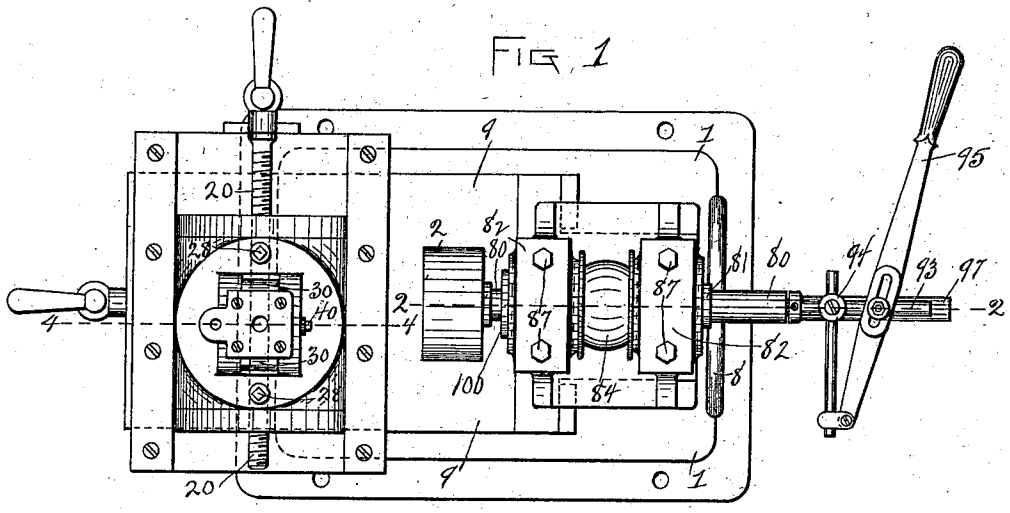


FIG 3

FIG. 1



WITNESSES

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attys

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NO MODEL. 3 SHEETS—SHEET 2.

FIG 4

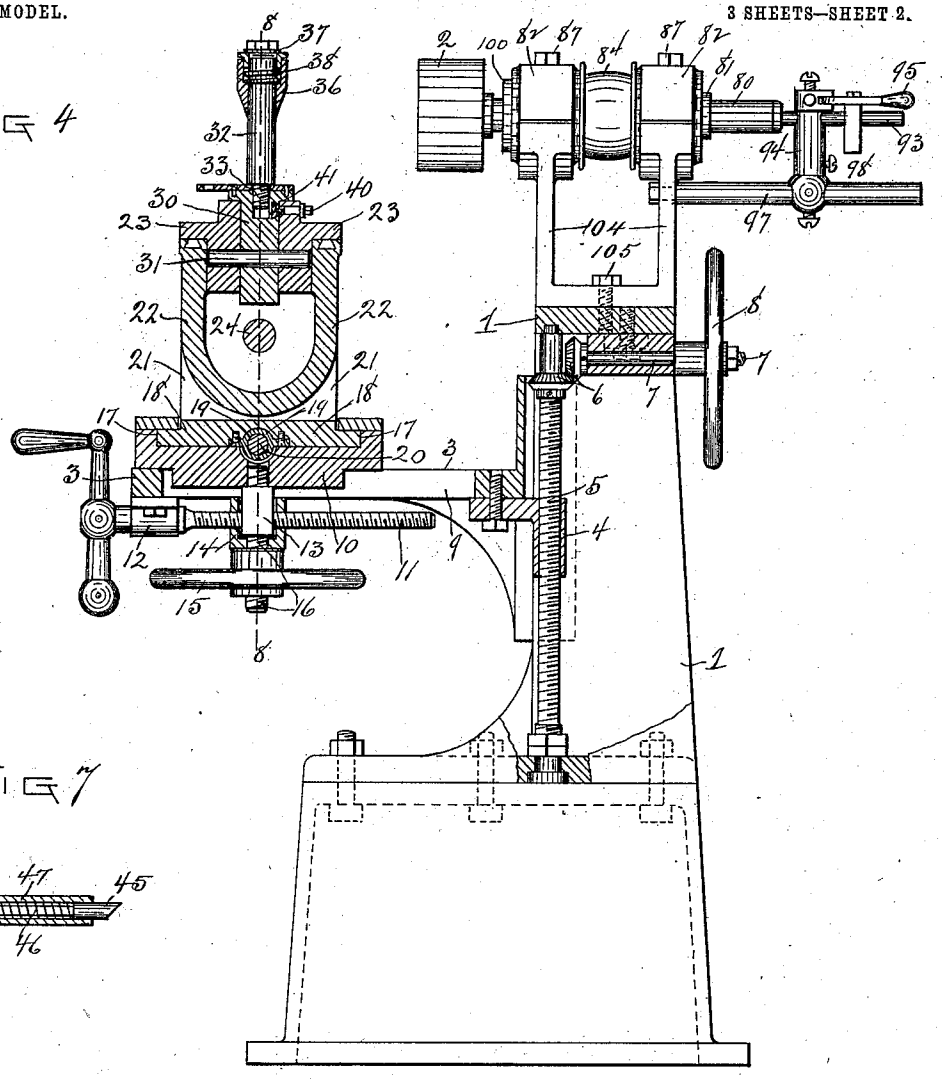
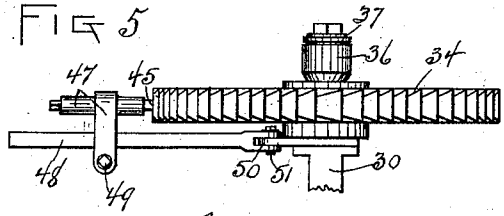


FIG 7

FIG 5



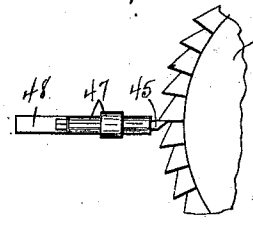


FIG 6

WITNESSES

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No. 727,981. PATENTED MAY 12, 1903.

W. F. LOMASNEY.

GRINDING MACHINE.

APPLICATION FILED JAN. 6, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

FIG 8

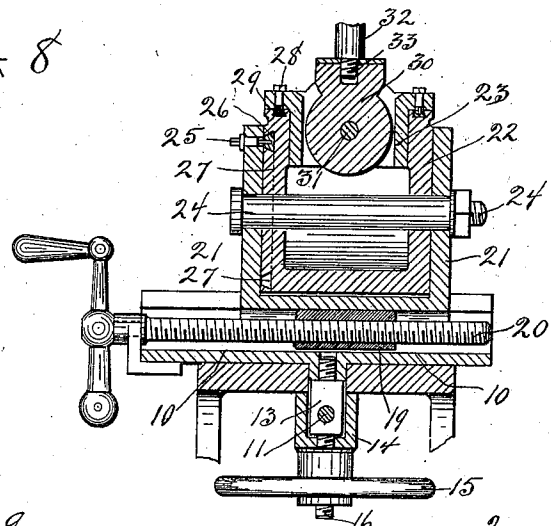


FIG 9

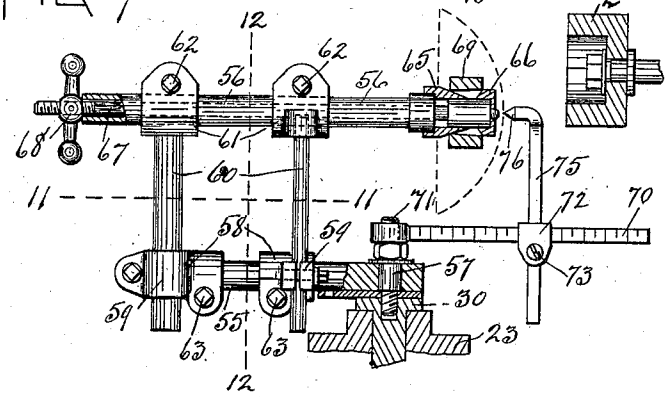


FIG 12

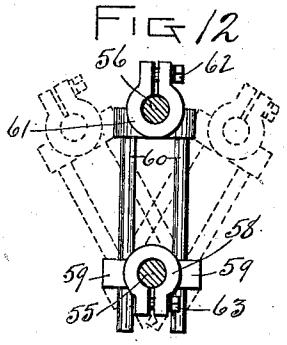


FIG 13

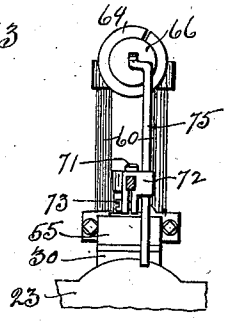


FIG 10

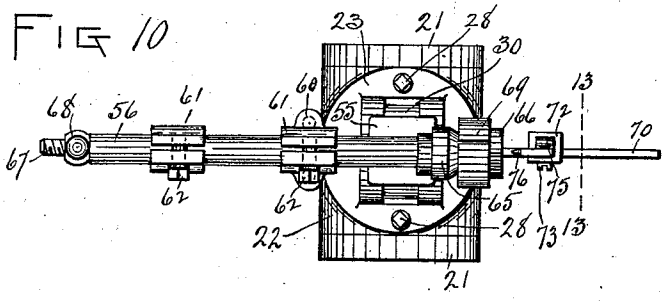
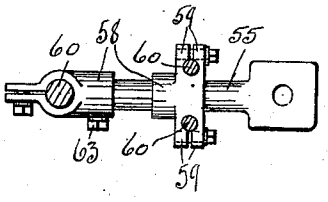


FIG 11



WITNESSES

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Atty

No. 727,981. Patented May 12, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM F. LOMASNEY, OF SCHENECTADY, NEW YORK, ASSIGNOR OF TWO-THIRDS TO CLARENCE HEATLY AND JAMES R. HOWGATE, OF SCHENECTADY, NEW YORK.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 727,981, dated May 12, 1903.

Application filed January 6, 1903. Serial No. 138,000. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. LOMASNEY, a citizen of the United States, residing at Schenectady, county of Schenectady, and State of New York, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures.

Figure 1 of the drawings is a top plan view of my improved grinding-machine. Fig. 2 is a central vertical longitudinal section through the grinding-tool and its supporting and operating mechanism, taken on the broken line 2 2 in Fig. 1. Fig. 3 is a vertical cross-section taken on the broken line 3 3 in Fig. 2. Fig. 4 is a view, partly in side elevation and partly in vertical section, taken on the broken line 4 4 in Fig. 1, of the machine shown therein. Fig. 5 is a view in side elevation of the upper end of one form of work-holder, showing a milling-cutter supported thereupon and held in a selected position of rotative adjustment by means of a catch-bolt mounted upon the work-holder. Fig. 6 is a top plan view of the catch-bolt and a portion of the work engaged thereby shown in Fig. 5. Fig. 7 is a horizontal longitudinal section of the catch-bolt and the housing therefor. Fig. 8 is a vertical section taken on the broken line 8 8 in Fig. 4. Fig. 9 is a view, partly in side elevation and partly in vertical section, of the grinding-tool, a portion of the turret, the oscillatory head-block mounted thereupon, and a different form of work-holder from that shown in the preceding figures. Fig. 10 is a top plan view of the same. Fig. 11 is a horizontal section taken on the broken line 11 11 in Fig. 9. Fig. 12 is a vertical cross-section taken on the broken line 12 12 in Fig. 9. Fig. 13 is a vertical cross-section taken on the broken line 13 13 in Fig. 10.

The invention relates more particularly to machines for dressing or sharpening milling-cutters and work of a like nature by subjecting the same to the action of an emery-wheel or other tool adapted for the work under treatment.

The principal object of the invention is to facilitate the presentation of the work to the tool in different positions necessary to secure the desired action of the tool thereupon.

Other objects of the invention will appear in connection with the following description.

The invention is particularly adapted for machines for sharpening or dressing the teeth of milling-cutters of various kinds and the drawings illustrate the invention applied to a machine of this kind.

Referring to the first eight figures of the drawings, 1 represents the frame of the machine, provided in its upper end with bearings for the spindle of the rotary tool 2, which may be an ordinary emery-wheel. The rotary tool may be of any known form and rotary movements may be imparted thereto in any known manner. The work-supporting bed 3 is mounted to slide vertically upon the frame of the machine and can be adjustably moved toward and from the tool by means of the nut 4, fixed to said bed and fitting the vertical screw-spindle 5, rotatively mounted in bearings on the frame of the machine and provided with a bevel-gear connection 6 with the horizontal shaft 7, having fixed thereon the hand-wheel 8, whereby said shaft can be rotated, all in the usual manner. The bed may be adjustably moved toward and from the tool in any other known manner. The bed is provided with a slideway 9 for the carriage 10, which is capable of slide movements along the bed toward and from the bed-operating spindle 5. Slide movements can be imparted to the carriage in any known manner, as by the screw-spindle 11, rotatory in a bearing 12 on the bed and held thereby against longitudinal movement, and a nut 13, fixed to said carriage and fitting said spindle. The carriage may be locked in adjusted position by means of the yoke 14, which embraces the spindle 11 and is caused to bind thereupon by engagement with the hub of the hand-wheel 15, having a screw connection

with the spindle 16, projecting from the nut 13. The carriage is provided with a slideway 17 for the slide 18, capable of slide movements in a line at right angles to the line of movement of the carriage upon the bed. Slide movements may be imparted to said slide upon the carriage in any known manner, as by a nut 19, fixed upon the slide and fitting the screw-spindle 20, capable of rotation without longitudinal movement upon the carriage. The slide is thus rendered capable of a universal adjustable movement in a single plane upon the bed. The slide is provided with a yoke-form upward projection 21, adapted to receive a turret-supporting head 22, upon which is mounted a rotary turret 23. The turret-supporting head is oscillatory upon the horizontal shaft 24, mounted upon the yoke 21, and means are provided for locking the head in selected positions of rotative adjustment, consisting of a bolt 25, inserted through one arm of the yoke 21 into the nut 26, fitting an annular undercut groove 27, formed in a side of the head concentric with its axis of oscillation. The turret 23 is mounted upon said head to rotate upon an axis at right angles to the shaft 24 or to the axis of oscillation of said head. The turret may be locked in selected positions of rotative adjustment upon the head by means of a bolt 28, inserted through a flange on said turret, overhanging an annular plane surface on the head at right angles to the axis of the turret into a nut 29, fitting an annular undercut groove formed in said plane surface on the head concentrically with the axis of rotation of the turret. A plurality of such bolt-and-nut connections may be employed, if desired, whereby the turret may be securely locked to the head. The turret supports a head-block 30, mounted thereupon to oscillate upon the shaft 31 at right angles to the axis of the turret, which shaft occupies a plane parallel with the shaft 24 and is adjustable in said plane at different angles to the shaft 24 by rotation of the turret. The head-block may be locked in selected positions of rotative adjustment by means of a bolt 40, inserted through an ear on the turret into a nut 41, located in an undercut groove in a side of the head-block, forming an arc concentric with the axis of oscillation of the head-block.

The head-block 30 is adapted to support a work-holder, which may be of any known form. I have shown one style of work-holder in the form of a post or spindle 32, provided with a screw-threaded end 33, adapted to screw into a similarly-threaded socket in the head-block. This spindle is adapted to receive a bored article, as a milling-cutter 34, the bore of which is of somewhat greater diameter than said spindle. The outer end of the spindle is provided with a cone-follower 36, adapted to enter the bore in the held article and force the article against a stop, which may be an offsetting portion of the head-block, and at the same time center the work upon the spindle. The cone 36 is yieldingly held in engagement with the bored article by means of the nut 37, applied to the screw-threaded outer end of the spindle, and the spring 38, inserted between said nut and cone. The article is thus held centered upon the spindle, while left free to be rotated thereupon. The work-holder is thus adjustable upon two axes of oscillation or rotation at right angles to each other and is also adjustable upon three axes of oscillation or rotation, two of which (represented by the shafts 24 and 31) are at right angles to the third, (represented by the axis of the turret.) A very wide range of rotative adjustment is thus given to the work-holder thus mounted, in addition to which the work-holder has a universal adjustment in straight lines by reason of the vertical movement of the bed, slide movement of the carriage in one direction at right angles to the movement of the bed, and slide movement of the slide at right angles to both the slide movement of the carriage and the vertical movement of the bed. It is thus possible to present the work to the tool in almost any conceivable position and is also possible to impart to the work such movement of reciprocation and oscillation as will cause portions of the article being dressed to traverse the tool in straight or curved lines in various directions.

In dressing the teeth of a milling-cutter it is necessary to secure the best results that the successive teeth should be presented in precisely the same manner to the emery-wheel or dressing-tool. To facilitate such a result, I provide a catch-bolt mounted upon a suitable support and adapted to interlock with the successive teeth of the supported article when rotated. I have shown the catch-bolt 45, controlled by spring 46, mounted in the housing 47, adjustable longitudinally upon the arm 48 and adapted to be locked in adjusted positions upon said arm by means of the bolt 49, the arm 48 being mounted upon the work-holder preferably by means of an adjustable hinge connection, as shown at 50, capable of being locked in adjusted position by means of the bolt 51. The catch-bolt can thus be adjusted in position to interlock with a tooth of the milling-cutter held by the work-holder and forms a positive stop for the face of the tooth, and when so adjusted will by engagement of its beveled end with the beveled backs of the several teeth yield to permit each tooth to slip past the bolt as the cutter is rotated by the hand of the operator to present the teeth successively to the tool, and when a tooth has thus slipped past the bolt the latter is immediately projected by its spring into position to form a positive stop, against which the face of said tooth can be held during the presentation of a tooth in another portion of the cutter to the tool. By means of the hinged connection 50 the catch-bolt can be adjusted to engage a tooth on the cutter diametrically opposite the tooth being

acted upon by the tool or at any intermediate angle thereto, as may be most convenient for the operator.

The work-holder above described is more particularly adapted for holding disk cutters. I have shown in Figs. 9 to 12 a form of work-holder more particularly adapted for ball cutters or cutters having spherical surfaces. This style of work-holder comprises an offset frame mounted upon the head-block 30 in place of the post or spindle 32, said frame being preferably adapted to rotate upon said head-block on an axis at right angles to the axis of oscillation of the head-block, and having an overhanging work-holding arm preferably shiftable transversely of the axis of rotation of the frame. This frame comprises a pair of parallel members 55 and 56, with adjustable sliding connections therebetween located at one side of the axis of rotation of the frame. The member 55 is adapted to be secured to the head-block by means of a screw 57 inserted through a plain aperture in one end thereof into the screw-threaded socket in the head-block, the outer end of said member being of spindle form and provided with a pair of split sleeves 58, clamped thereon by means of bolts 63 and having split bearings 59, adapted to receive the transverse sliding members 60, connected with the respective split sleeve 61, clamped upon the member 56 by means of the bolts 62. The inner end of the member 56 projects beyond the sleeves 61 to form an overhanging arm adapted to serve as a work-holder. By loosening the bolts 62 the member 56 may be reciprocated through the sleeves 61 to vary the overhang of such arm to accommodate the device to work of different styles. The arm can thus be made to so overhang the axis of rotation of the frame, which is the axis of the screw or bolt 57, that when an article is held upon said arm the axis of rotation of the frame and held article will pass through said article. By loosening the bolts 63 the members 56 and 60 can be rocked upon the member 55 to shift the overhanging work-holding arm transversely of the axis of rotation of the frame. When said arm has been shifted to one side or the other of said axis, rotary movements of the frame will impart to the work held by said arm a rotary movement upon an axis located within and to one side of the center of the held article. A swinging or rotative movement of this work-holding frame while the held article is in contact with the emery-wheel will cause the grinding or dressing of convexed surfaces on said article when the axis of rotation occupies a position in front of the emery-wheel and the grinding of concaved surfaces thereon when the axis of rotation passes through or in rear of said wheel.

The work-holder shown in Figs. 9 and 10 comprises a cone 65, fixed upon the overhanging arm of member 56 and the movable cone 66, fixed upon the inner end of spindle 67, reciprocatory through the member 56, which is in the form of a sleeve. The spindle 67 is provided with a screw-threaded outer end adapted to receive a hand-nut 68, whereby the spindle may be operated to move the cone 66 toward the cone 65 to cause the expansion of the split sleeve 69, within the opposite ends of which said cones are respectively inserted. The split sleeve when contracted is adapted to loosely occupy the bore of the milling-cutter or like article and when expanded is adapted to tightly fill said bore and hold the article securely in position.

As a means for accurately determining the radius of curvature imparted to the surface dressed or ground by the emery-wheel I have shown an arm 70, provided with a graduated scale and pivotally mounted upon the stud 71, projecting from the upper end of the screw-bolt 57 and in axial line therewith, whereby said arm is adapted to swing upon the same axis as the work-holding frame. The arm 70 is provided with a sliding split index-sleeve 72, adapted to be clamped thereupon in adjusted positions by means of the screw 73 and provided with a split bearing 74, adapted to receive the index-rod 75, having an offset end 76. The scale is so arranged that the reading of the position of the index-sleeve correctly indicates the distance of the offset end 76 of the index-rod from the axis of rotation of the work-holding frame. In making ready for the grinding operation the sleeve 72 is set for the desired radius of curvature, and the work-holding member 56 is moved through the sleeves 61 until the portion of the held article to be ground is caused to engage the offset end 76 of the index-rod. The index-rod, index-sleeve, and arm 70 may be removed during the grinding operation when desired.

In grinding certain kinds of work it is desirable to have the emery-wheel quickly traverse the plane surface of the article under treatment. I therefore provide means for imparting to the emery-wheel reciprocating movements on straight lines, as well as rotary movements. The wheel is fixed upon the inner end of a spindle 80, capable of longitudinal slide movements through a sleeve 81, rotatively supported in divided bearings 82 on the upper end of the frame of the machine, to which sleeve rotary movements are imparted by a belt (not shown) through the pulley 84, fixed upon said sleeve by a pin or screw 85, which also passes through and fits an elongated slot 86 in the tool-spindle 80, whereby the pulley, sleeve, and spindle are connected to rotate in unison, while reciprocating movements of the spindle within the sleeve are permitted. The sleeve 81 is provided with a biconical bearing-flange 86, adapted to fit a corresponding groove in a divided bearing 82, whereby said sleeve is held from longitudinal movement, and wear upon said bearing-flange can be taken up by tightening the bolts 87, whereby the parts of the divided bearing are held together and clamped upon said sleeve. The outer end of the spin-

dle 80 is provided with a radial aperture, within which is inserted an end of the spindle 89, upon which the spindle 80 is adapted to freely turn, said spindles being rotatively connected together by means of a pin 90, inserted through the spindle 80 and occupying a peripheral groove 91 in the spindle 89. An oil-passage 92 permits the admission of a lubricant between the engaging surfaces of said spindles. The spindle 89 is fixed upon an arm 93 reciprocatory in a slide-bearing 94 and is adapted to be operated by a lever-handle 95 in the usual manner to impart slide movements to the tool-spindle. The slide-bearing 94 is vertically adjustable upon a post 96, erected from the arm 97, fixed upon the frame of the machine. The slide-bearing 94 may be locked in selected positions of vertical adjustment by means of the set-screw 98, such adjustment permitting the perfect alinement of the axes of the spindles 80 and 89 regardless of wear upon the bearing-surface of the sleeve 81, which would tend to cause the axis of the spindle 80 to occupy a lower plane. The sleeve 80 is provided exteriorly of the bearing 82 with a flange 100, and a packing-ring 101 is inserted and held between said flange and the adjacent bearing to prevent the entry of grit from the emery-wheel within the bearing for the sleeve 81. The pulley 84 serves the function of a like flange on the other side of the bearing, the packing-ring 102 being held between said pulley and the adjacent bearing.

The bearings for the grinding-tool are preferably mounted on a yoke 104, supported upon the frame of the machine and adapted to rotate thereupon upon a vertical axis, as upon the pivot-bolt 105, in the usual manner.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a machine of the class described, the combination with a tool; of a work-holder oscillatory upon three axes two of which occupy parallel planes at right angles to the third, one of said two being adjustable in its plane at different angles to the other.

2. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on two axes at right angles to each other.

3. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on three axes two of which occupy parallel planes at right angles to the third.

4. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on three axes two of which occupy parallel planes at right angles to the third, one of said two being adjustable in its plane at different angles to the third.

5. In a machine of the class described, the combination with a tool; of a bed adjacent thereto; a slide universally adjustable in a single plane upon said bed; a turret; a turret-supporting head mounted upon said slide to oscillate upon an axis at right angles to the axis of the turret; and a work-holder mounted on said turret and oscillatory thereupon on an axis at right angles to the axis of the turret.

6. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a work-holder mounted upon said bed and oscillatory thereupon on two axes at right angles to each other.

7. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a work-holder mounted upon said bed and oscillatory thereupon on two axes occupying parallel planes one of which axes is adjustable in its plane at different angles relatively to the other.

8. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a work-holder mounted upon said bed and oscillatory thereupon on three axes, two of which occupy parallel planes at right angles to the third.

9. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a work-holder mounted upon said bed and oscillatory thereupon on three axes, two of which occupy parallel planes at right angles to the third, one of said two being adjustable in its plane at different angles to the other.

10. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving the bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on two axes at right angles to each other.

11. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving the bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on two axes occupying parallel planes one of which axes is adjustable in its plane at different angles relatively to the other.

12. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving the bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; and a work-

holder mounted upon said slide and oscillatory thereupon on three axes, two of which occupy parallel planes at right angles to the third.

13. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving the bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; and a work-holder mounted upon said slide and oscillatory thereupon on three axes, two of which occupy parallel planes at right angles to the third, one of said two being adjustable in its plane at different angles to the other.

14. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving the bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; a turret; a turret-supporting head mounted upon said slide to oscillate upon an axis at right angles to the axis of the turret; and a work-holder mounted on said turret and oscillatory thereupon on an axis at right angles to the axis of the turret.

15. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a turret mounted upon said bed; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

16. In a machine of the class described, the combination with a tool; a bed adjacent thereto; and a slide adjustably mounted on said bed; of a turret mounted upon said slide; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

17. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a turret; a turret-supporting head mounted upon said bed to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

18. In a machine of the class described, the combination with a tool; a bed adjacent thereto; and a slide adjustably mounted upon said bed; of a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

19. In a machine of the class described, the combination with a tool; a bed adjacent thereto; and a slide universally adjustable in a single plane upon said bed; of a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

20. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a turret; a turret-supporting head mounted upon said bed to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm.

21. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from the tool; of a slide adjustably mounted upon said bed; a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block and having an overhanging work-holding arm.

22. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; of a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block and having an overhanging work-holding arm.

23. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a turret mounted upon said bed; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

24. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of an offset frame mounted upon said bed to rotate thereupon and having a work-holding overhanging arm shiftable transversely of the axis of rotation of said frame.

25. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a head-block mounted on said bed to oscillate thereupon; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

26. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a turret; a turret-supporting head mounted upon said bed to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

27. In a machine of the class described, the combination with a tool; a bed adjacent thereto; and a slide adjustably mounted upon said bed; of a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

28. In a machine of the class described, the combination with a tool; a bed adjacent thereto; and a slide universally adjustable in a single plane upon said bed; of a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

29. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from said tool; of a turret; a turret-supporting head mounted upon said bed to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said turret; and an offset frame mounted upon said head-block to rotate thereupon on an axis at right angles to the axis of oscillation of said head-block, and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

30. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from the tool; of a slide adjustably mounted upon said bed; a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

31. In a machine of the class described, the combination with a tool; a bed; and means for adjustably moving said bed toward and from the tool; of a slide universally adjustable in a single plane upon said bed; a turret; a turret-supporting head mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; a head-block mounted upon said slide to oscillate thereupon on an axis at right angles to the axis of the turret; and an offset frame mounted upon said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

32. In a machine of the class described, the combination with a tool; and a bed adjacent thereto; of a turret mounted upon said bed; a head-block mounted upon said turret to oscillate thereupon on an axis at right angles to the axis of the turret; means for locking certain of said members in selected positions of rotative adjustment; and an offset frame mounted upon said head-block and having an overhanging work-holding arm shiftable transversely of the axis of rotation of said frame.

33. In a machine of the class described, a holder for bored articles comprising in combination a spindle mounted upon a suitable support and adapted to loosely occupy the base of the held article; a stop engageable with said article on one side; a cone on said spindle insertible in the bore of said article on its other side; and means for producing a relative movement between said cone and stop, substantially as described.

34. In a machine of the class described, a holder for bored articles, comprising in combination a spindle mounted upon a suitable support; a split sleeve loosely inclosing said spindle and insertible in the bore of the held article; a pair of cones insertible within the opposite ends of said split sleeve; and means for moving one of said cones toward the other to expand said split sleeve, substantially as described.

35. In a machine of the class described, the combination with a work-support; of a tool; a tool-supporting spindle having a biconical flange; a divided bearing for said spindle

provided with a groove adapted to fit said biconical flange; means for clamping the flanged spindle between the bearing members; and means for rotating said spindle, substantially as described.

36. In a machine of the class described, the combination with a work-support; of a tool; a sleeve having an external biconical flange; a divided bearing for said sleeve provided with a groove adapted to fit said flange; means for clamping the flanged sleeve between the bearing members; means for rotating said sleeve; a tool-supporting spindle reciprocatory longitudinally within said sleeve and connected to rotate therewith; and means for reciprocating said spindle, substantially as described.

37. In a machine of the class described, the combination with a work-support; of an abrasive tool; a bearing; a tool-supporting spindle rotatively mounted in said bearing and having a biconical bearing-flange fitting a corresponding groove therein; and a flange located exteriorly of said bearing; means for rotating said spindle; and a packing-ring held between said exterior flange and said bearing, substantially as described.

38. In a machine of the class described, the combination with a work-support; of a tool; a divided bearing; a sleeve having two external flanges, one located exteriorly of said bearing and the other biconical in form and fitting a corresponding groove therein; a packing-ring held between said outer flange and bearing; means for clamping the flanged sleeve between the bearing members; means for rotating said sleeve; a tool-supporting spindle reciprocatory longitudinally within said sleeve and connected to rotate therewith; and means for reciprocating said spindle, substantially as described.

39. In a machine of the class described, the combination with a work-support; of a tool; a sleeve having an external biconical flange; a divided bearing for said sleeve provided with a groove adapted to fit said flange; means for clamping the flanged sleeve between the bearing members; means for rotating said sleeve; a tool-supporting spindle reciprocatory longitudinally within said sleeve and connected to rotate therewith; means for reciprocating said spindle; and a vertically-adjustable slide-bearing for the outer end of said spindle, substantially as described.

In testimony whereof I have hereunto set my hand this 18th day of December, 1902.

WILLIAM F. LOMASNEY.

Witnesses:

RENSSELAER J. COOPER,

JAMES C. COOPER.