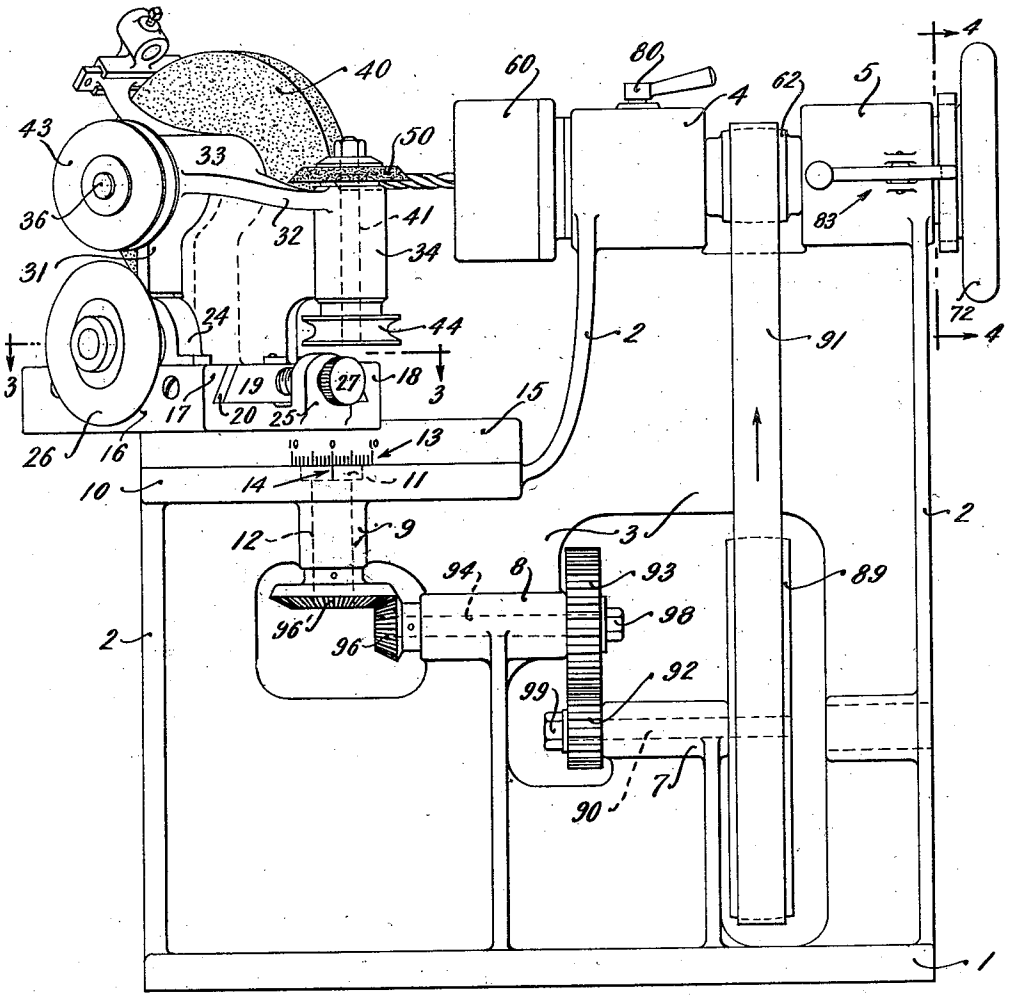
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DRILL GRINDING

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Fig. 1.



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Fig. 2.

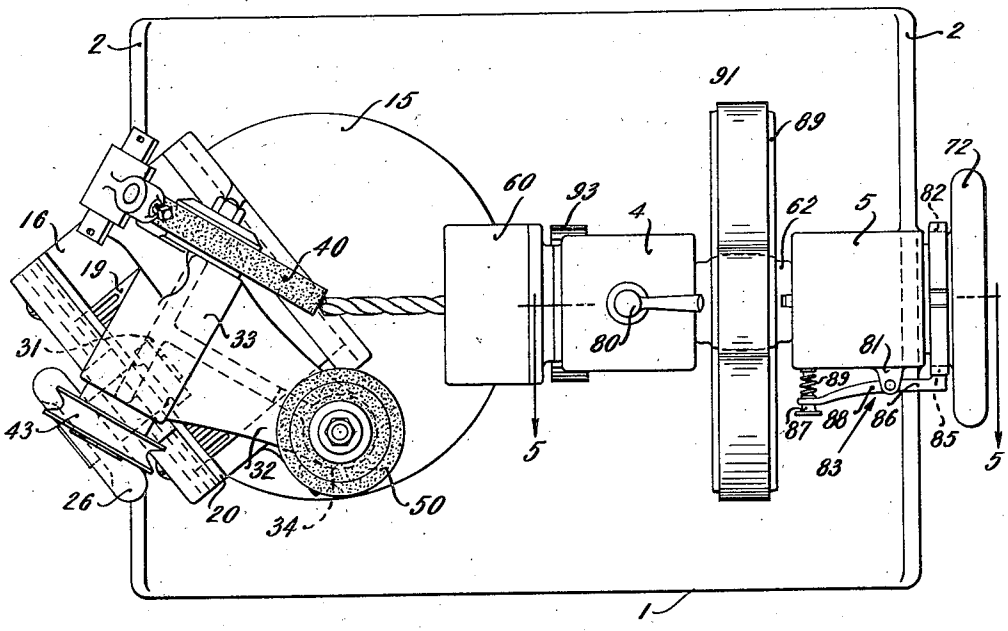


Fig. 3.

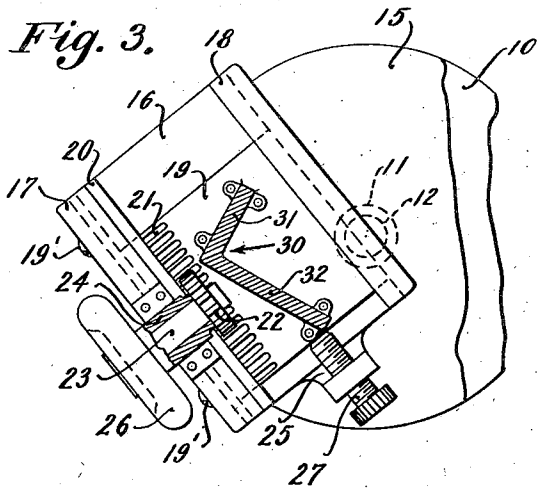
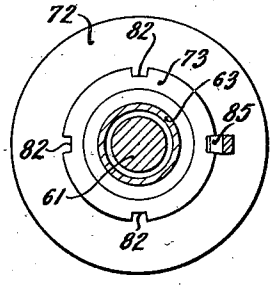


Fig. 4.



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Fig. 5.

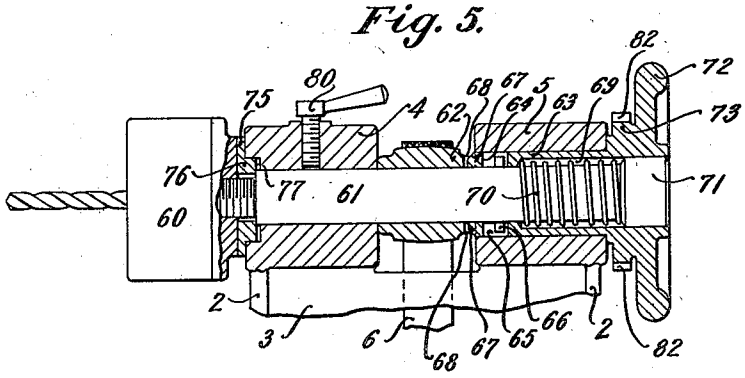


Fig. 6.

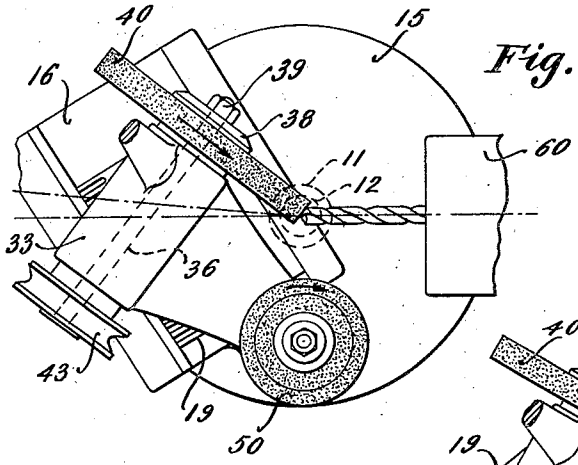


Fig. 7.

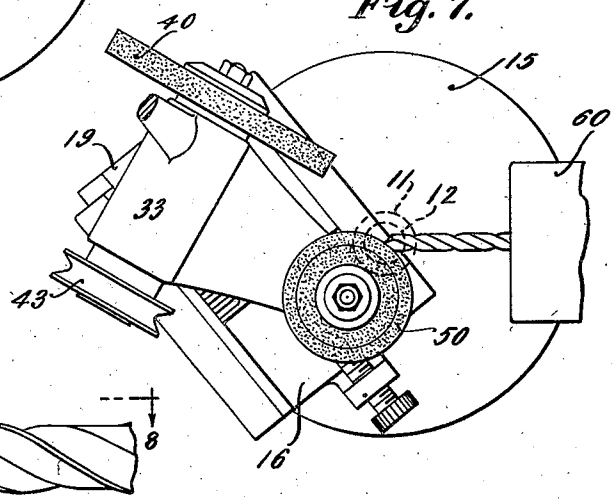


Fig. 8.

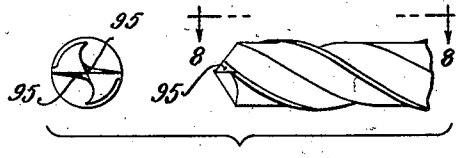


Fig. 9.



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DRILL GRINDING

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Application June 4, 1931, Serial No. 542,026

9 Claims. (Cl. 51—33)

This invention relates to apparatus for grinding and sharpening drills.

It is recognized that the cutting end of a properly ground drill should conform to the following requirements: The cutting edges should incline at the proper angle with the axis, each edge having the same length and inclination; the angle of clearance back of the cutting edge should be sufficient to permit the drill to cut freely and efficiently; and the clearance should be the same on each side, in other words, the end of the drill should be perfectly symmetrical.

One object of this invention is to provide a simple and efficient apparatus by means of which a drill may be quickly ground to conform with the above requirements. Another object of this invention is to provide improved facilities for sharpening the cutting edges of the drill, supplementary to the normal grinding operation, and to provide means for decreasing the width of the central non-cutting web portion.

Further objects and advantages will be apparent as attributes of the construction and operation of the apparatus herein described in connection with the accompanying drawings which exemplify one embodiment chosen for the purpose of illustration.

In the drawings:

Fig. 1 is a side elevation of the apparatus;

Fig. 2 is a top plan view;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a section on the line 5—5 of Fig. 2;

Fig. 6 is a plan view showing the position of the grinding wheel, relative to the drill, at the completion of the first step of the normal grinding operation;

Fig. 7 is a view similar to Fig. 6 illustrating the operation of the sharpening disk;

Fig. 8 is a composite view of a drill ground and sharpened with the above apparatus; and

Fig. 9 is a side elevation of the drill viewed from the line 8—8 of Fig. 8.

Referring to the drawings, particularly Figs. 1 and 2, the apparatus herein illustrated comprises a main frame which may be a unitary metal casting such as iron, aluminum, or other suitable material which provides a strong and rigid structure. The frame comprises a base 1 having upright webs 2 and 3 which support the horizontally aligned cylindrical bearing members 4 and 5, bearing members 7, 8 and 9, and the horizontally disposed circular platform 10. Each of the bearing members is in vertical alignment, the members 7, 8 and 9 communicating with openings which receive the transmission mechanism hereinafter more fully described.

The platform 10 is provided with an opening concentric with the bearing member 9 and defining therewith a cylindrical bearing member having an enlarged bore at its upper end in which the boss 11 of shaft 12 is journaled. Mounted on the platform 10 is a rotatable supporting unit which preferably comprises a circular turntable 15 which is fixed to shaft 12. The turntable is provided with a scale 13 which cooperates with the index 14 on the platform to indicate the angular position of the turntable. As shown in Figs. 2, 6 and 7, the axis of rotation of the turntable is in the same vertical plane as the axial line of the bearing members 4 and 5 and at right angles thereto.

The bed plate 16 is secured to the turntable by machine screws or other suitable means and is eccentrically disposed relative to its axis of rotation. The bed plate is provided with dovetail flanges or guides 17 and 18 along opposite longitudinal edges and a lug 25 projects upwardly from its forward end. The carriage 19 is slidably mounted on plate 16 intermediate the flanges 17 and 18 and is provided with inclined surfaces along its opposite longitudinal edges which cooperate with the machine slide 20 and flange 18 to secure the carriage to the bed plate and also to provide means for preventing play or lateral movement of the carriage relative to the plate. By means of the screws 19' the machine slide 20 can be adjusted to vary the sliding fit of the carriage.

The upper surface of the carriage adjacent to the flange 17 is provided with a toothed portion or rack 21 which engages a pinion 22 mounted on shaft 23 which is journaled in the bracket 24. By means of the hand-wheel 26 pinned or otherwise secured to the outer end of shaft 23 the carriage is moved forward or backward, its forward movement being limited by an adjustable stop which comprises a set screw 27 threaded in bracket 25.

The T-shaped bracket 30 is secured to the carriage by machine screws or other suitable means and carries bearing portions 33 and 34 (Fig. 1) which are integral with its respective wings or web portions 31 and 32. A grinding wheel 40 is mounted on the end of a shaft 36, journaled in bearing 33, and is firmly secured thereto by any conventional means such as collar 38 and nut 39 (Fig. 6) threaded on the end of the shaft. In a similar manner the grinding disk 50 is fixed to

the shaft 41 which is journaled in bearing 34. On the opposite end of each of the shafts 36 and 41 suitable driving means are connected, such for example as pulleys 43 and 44. Preferably the grinding wheel 40 is so positioned on the turntable that when the index on the platform registers with the zero point on scale 13 the plane of rotation of the grinding wheel is at an angle of approximately 59° with the axial line of bearing members 4 and 5. Although the grinding disk 50 is shown in a horizontal plane passing through the axial line of bearing members 4 and 5, it is not necessary that the cutting surface of the disk 50 be in a horizontal plane passing through the median line of the drill.

The preferred embodiment of means for holding the drill in fixed position relative to the grinding wheel and disk comprises a conventional chuck 60 (Fig. 5) secured to the spindle 61 which is journaled in the cylindrical bearing member 4 and projects beyond the outer end of bearing member 5. The bearing member 5 is provided with an enlarged bore to accommodate clutch mechanism by means of which the pulley 62, loosely mounted on spindle 61, is connected to the spindle. The clutch mechanism comprises a sleeve 63 having a sliding fit on spindle 61 and provided with longitudinal slots 64 and 65. A pin 66 passes through the spindle and engages the slotted portions of the sleeve thus providing a connection between the sleeve and spindle and also serving to limit the axial movement of the sleeve. The end of the sleeve adjacent to the pulley is provided with projecting teeth 67 which engage corresponding recesses 68 in the adjacent end of pulley 62, thus providing a positive clutch between the spindle and pulley. A portion of the sleeve is provided with an enlarged bore which, with the spindle, defines an annular recess 69 for the reception of the coiled compression spring 70 which fits around the spindle. One end of the spring 70 bears against the shouldered portion of the sleeve provided by the enlarged bore and the other end against the shouldered portion of the spindle provided by the boss 71. The spring being compressed in this position urges the sleeve axially toward the pulley 62 thereby normally holding the toothed portions of the pulley and sleeve in interlocking engagement. The hand-wheel 72 and collar 73 are preferably integral with the sleeve and closely fit around the boss 71 of the spindle, as shown in Fig. 5, the boss serving as a bearing and preventing objectionable play.

In order to prevent axial movement of the spindle 61, a collar 75 may be interposed between the chuck 60 and bearing member 4. This collar is provided with a hub 76 which has a pressed fit within the annular recessed portion 77 of the bearing member 4 and thus provides an abutment or bearing surface for the shouldered portion of the spindle adjacent to its threaded end, thereby preventing axial movement toward the grinding wheel. The chuck 60 bears against the collar 75 and thus prevents axial movement of the spindle in the opposite direction.

It is apparent that rotation of the hand-wheel 72 not only rotates the spindle and chuck but also the pulley 62. In order to disengage the sleeve 63 from the pulley, the hand-wheel is pulled outwardly (toward the right in Fig. 5) to withdraw the teeth 67 from the recessed portions of the pulley, and the spindle may then be rotated without rotating the pulley. The spindle may be locked in any desired position by means of the screw clamp 80 which is threaded in an aperture in the bearing member 4.

It is preferable to provide means for determining the initial and final position of the spindle and for limiting its movement during the normal grinding operation, and to this end the collar 73 is provided with a plurality of circumferentially spaced recesses 82, four such recesses spaced 90° apart (Fig. 4) being desirable. The spring-pressed lever 83 pivoted in bracket 81 on the bearing member 5 is provided with a projecting lug 85 on the end of arm 86, which lug normally engages a recessed portion of the collar 73 as shown in Fig. 2 and thus locks the sleeve and spindle in one of their four rest positions. By depressing the button 87 on arm 88 the lug is moved outwardly to unlock the sleeve, thus permitting the hand-wheel to be rotated 90° when, under the action of spring 89, the lug will engage another recessed portion of the collar, thus locking the hand wheel and limiting the movement of the spindle and pulley.

The turntable 15 may be rotated with the spindle 61 by any suitable transmission mechanism such, for example, as that shown in Fig. 1, which comprises a pulley 89 mounted on shaft 90 which is journaled in bearing member 7, the pulley 89 being operatively connected to pulley 62 by belt 91. The gear 92 mounted on the opposite end of shaft 90 is driven by pulley 89 and engages gear 93 mounted on shaft 94 which is journaled in bearing member 8 and which in turn drives the beveled gears 96 and 96′ pinned or otherwise suitably secured to shafts 94 and 12 respectively.

As shown in Fig. 1 the ratio of the driving gears to the driven gears is such that for a 90° movement of the spindle the turntable preferably rotates only a few degrees, for example, approximately 4°. However, the rotation of the turntable for a given movement of the spindle may be varied by changing the gear ratio, and for this purpose the gears 92 and 93 preferably are secured to their respective shafts by means, such as bolts 98 and 99, which permit the gears to be easily removed and others substituted.

A drill to be ground and sharpened is positioned in chuck 60 so that its point extends to or slightly beyond the axis of rotation of the turntable, as shown in Figs. 2 and 6, and its cutting edges or lips lie in horizontal planes (as shown in Fig. 8). During this adjustment the hand-wheel 72 should be locked in one of its four rest positions (Fig. 2). When thus positioned the longitudinal median line of the drill coincides with the axis of rotation of the spindle and the drill is correctly positioned.

After the drill is positioned as aforesaid, it is subjected to four grinding operations, two by the wheel 40 which correspond to the usual drill grinding operations on the end of the drill and two by the disk 50 which face off the longitudinal sides of the cutting edge. The latter operations also reduce the transverse dimension of the central web of the drill which bridges the two cutting edges, extending the cutting edges to or near the axis of the drill. The axis of the wheel 40 is disposed in or slightly below the horizontal plane of the axis of the drill; and the lower face of the disk 50 is disposed slightly below the horizontal plane of the adjacent cutting edge of the drill so as to face off a very slight amount of the longitudinal side of the cutting edge. The aforesaid four grinding operations may be performed in any desired order but the

preferred procedure is as follows: With the turntable 16 in its initial position (Figs. 1 and 7) and with the wheel 40 rotating at the desired speed (in the direction of the arrow in Fig. 6) it is advanced by the hand-wheel 26 until its periphery is substantially tangent to the axis of the turntable where it is stopped by adjusting screw 27; and inasmuch as the drill projects slightly beyond this axis, the grinding operation will begin as the wheel approaches the aforesaid tangent position. When the wheel reaches this position the hand-wheel 26 is stopped and the hand-wheel 72, after being freed from latch 83, is turned 90° in a counterclockwise direction (Fig. 4) to turn the turntable 15 in a clockwise direction (Figs. 2, 3, 6 and 7) from the initial position of Fig. 7 to an advanced position (Fig. 6) depending upon the degree of clearance desired as determined by the pulley and gear ratios. After hand-wheel 72 has been turned 90° it is automatically stopped by latch 83, at which time the first grinding operation is completed. Grinding wheel 40 is then retracted by hand-wheel 26 and the turntable is brought back to initial position by hand-wheel 72. Grinding disk 50, rotating at full speed in the direction of the arrow (Fig. 6) is then advanced by hand-wheel 26 until its maximum peripheral edge almost reaches the axis of the drill, thereby facing off the longitudinal side of one of the cutting edges and extending the cutting edge nearer to the axis of the drill. If desired a stop like 27 may be provided at the other end of the carriage to limit the advance movement of the disk. After this second grinding operation the grinding disk is backed away, the drill is rotated 180° by hand-wheel 72 with clutch 67, 68 disengaged (so as not to actuate the turntable) and the aforesaid grinding operations are repeated.

Figs. 8 and 9 show different views of a drill ground and sharpened in accordance with this invention. It will be noted that the ends of the drill are perfectly symmetrical and are provided with gradually increasing similar clearances back of their cutting edges. The cutting edges have also been faced off at 95 and extend in the same plane to the point of the drill, the web portion having been reduced substantially to a point so as to offer substantially no resistance to the cutting operation.

While I have shown and described one desirable embodiment of this invention, I wish it to be understood that various changes in shape, proportion and arrangement of parts, as well as substitution of equivalent elements for those herein shown and described may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. Apparatus of the character described comprising a rotatable support, a grinding wheel adjustably mounted on said support and operable in a predetermined path, means for holding a drill in operative engagement with said grinding wheel and in fixed relation to its path of operation, said means comprising a spindle rotatable about an axis intersecting the axis of rotation of said support, and a chuck secured to said spindle, and means for simultaneously rotating said spindle and rotatable support.

2. Apparatus of the character described comprising a rotatable support, a grinding wheel rotatably mounted on said support and operable in a predetermined path, a spindle rotatable about an axis intersecting the path of operation of said grinding wheel, a chuck coaxial with said spindle and secured thereto, means for transmitting movement of said spindle to said support, and clutching means normally engaging said transmitting means for rotating said spindle.

3. Apparatus of the character described comprising a rotatable support, a grinding wheel rotatably mounted on said support and operable in a predetermined path, a spindle rotatable about an axis intersecting the path of operation of said grinding wheel, said spindle having a chuck coaxial therewith for holding the cutting edge of a drill in engagement with said grinding wheel, means for transmitting movement of said spindle to said support, and clutching means normally engaging said transmitting means and spindle for rotating the latter, said clutching means being disengageable from said transmitting means whereby said spindle may be rotated similarly to position, relative to said grinding wheel and path of operation, the other cutting edge of the drill.

4. Apparatus of the character described comprising a rotatable support, a grinding wheel rotatably mounted on said support and operable in a predetermined path, a spindle rotatable about an axis intersecting the path of operation of said grinding wheel, said spinde having a chuck coaxial therewith for holding the cutting edge of a drill in engagement with said grinding wheel, means for transmitting movement of said spindle to said support, and means for rotating said spindle, said latter means including a clutch mounted on said spindle and normally engaging said transmitting means, said clutch being disengageable from said transmitting means whereby said spindle may be rotated similarly to position, relative to said grinding wheel and path of operation, the other cutting edge of the drill.

5. A drill grinding machine comprising a rotatable support, a bracket secured to said support and rotatable therewith, means including a rack and pinion for moving said bracket relative to said support, a grinding wheel mounted on said bracket and operable in a plurality of paths, means for limiting the movement and adjusting the position of said bracket, relative to said support, to define a fixed path of operation of said grinding wheel, and means for holding a drill in operative engagement with said grinding wheel so that the longitudinal median line of the drill is maintained in fixed position relative to the fixed path of operation of the grinding wheel.

6. A drill grinding machine comprising a support rotatable about a fixed axis, a bracket slidably secured to said support and rotatable therewith, mechanism for moving said bracket relative to said support, a grinding disk mounted on said bracket and rotatable about an axis substantially parallel to the axis of rotation of said support, and means for holding a drill in fixed position so that one of its cutting lips lies in the path of operation of said grinding disk, said drill holding means being rotatable so that another cutting edge of said drill may be similarly positioned relative to said grinding disk and path of operation.

7. Apparatus of the character described comprising a rotatable support, a bracket slidably mounted in said support, a grinding wheel rotatably mounted on said bracket, a second grinding wheel mounted on said bracket and rotatable in a different plane from the first grinding wheel, means for holding a drill in fixed operative rela-

tion to the paths of operation of each of said grinding wheels, and means for bringing said grinding wheels into operative engagement with the cutting edges of said drill.

8. Apparatus of the character described comprising means for holding a drill in fixed position, a support rotatable about a fixed axis relative to the longitudinal median line of said drill, a bracket slidably mounted on said support, a grinding wheel mounted on said bracket, a second grinding wheel mounted on said bracket and rotatable in a different plane from the first grinding wheel, said grinding wheels being operable in paths intersecting the longitudinal median line of said drill, and means for moving said bracket to bring one or the other of said grinding wheels into engagement with said drill.

9. Apparatus of the class described comprising a rotatable support, a bracket slidably mounted on said support, a grinding wheel mounted on said bracket, a second grinding wheel mounted on said bracket and rotatable in a plane substantially at right angles to the plane of rotation of the first grinding wheel, means for holding a drill in predetermined fixed position relative to the paths of operation of said grinding wheels, and means for moving said bracket to bring one or the other of said grinding wheels into engagement with said drill.

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