April 15, 1941. C. E. KRAUS 2,238,064

CUTTER GRINDING METHOD

Filed May 16, 1938 4 Sheets-Sheet 1

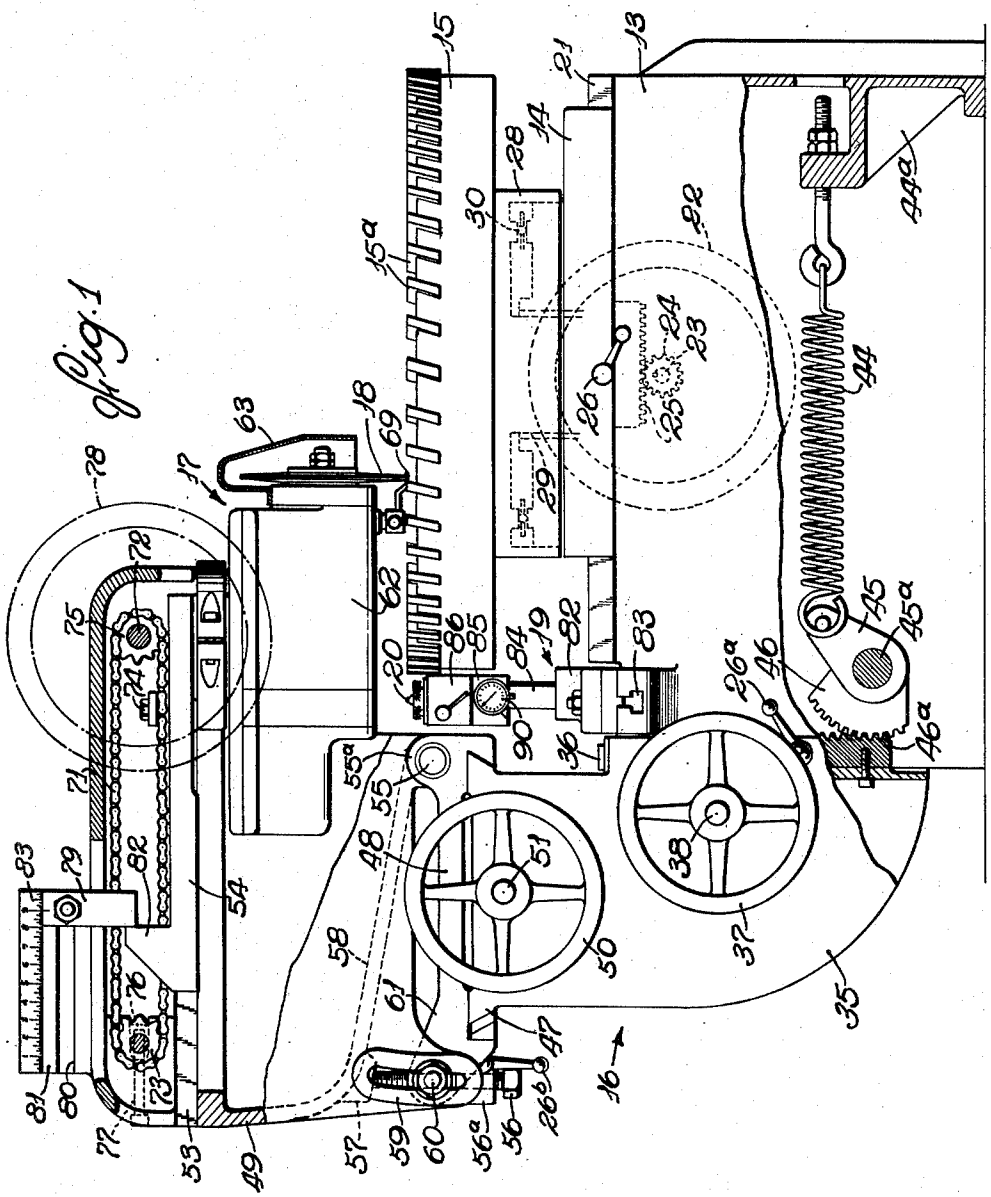


Fig. 1

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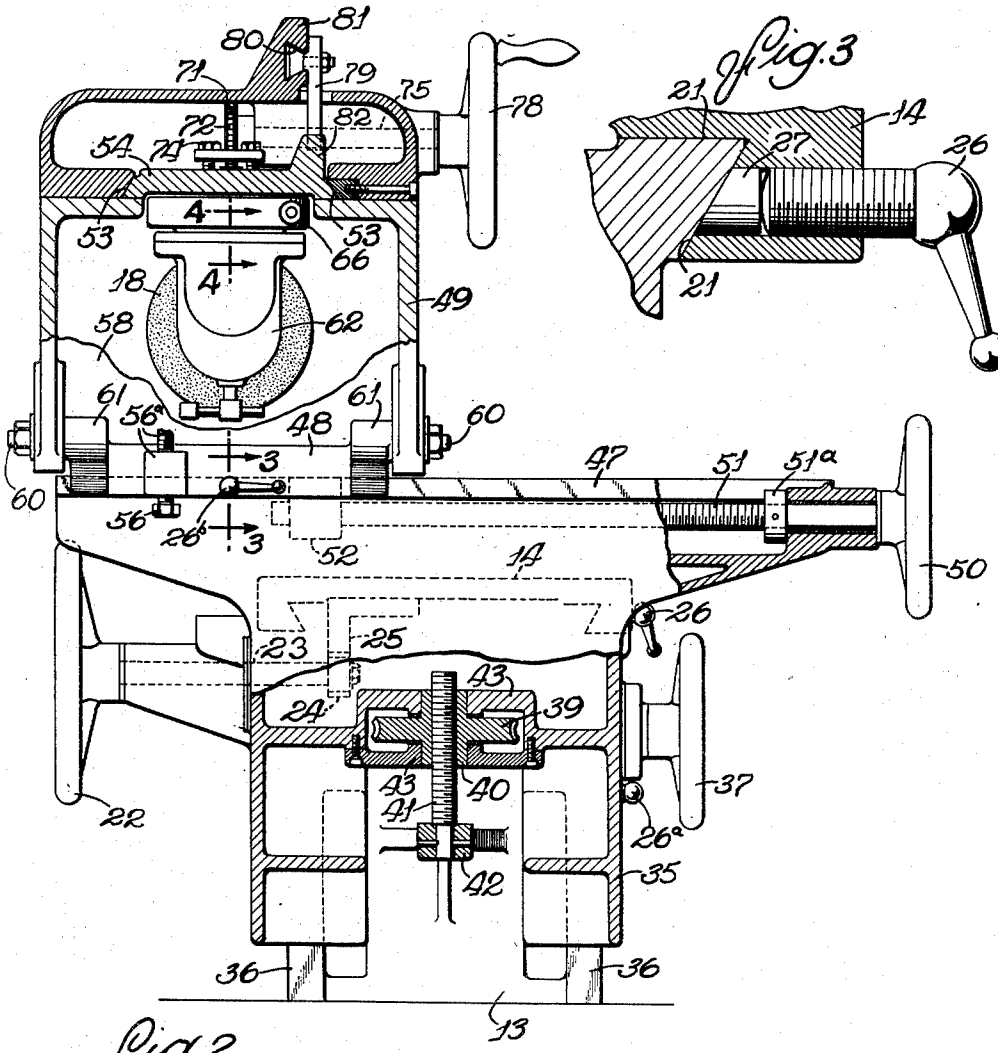


Fig. 2

Fig. 3

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CUTTER GRINDING METHOD

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Fig. 4

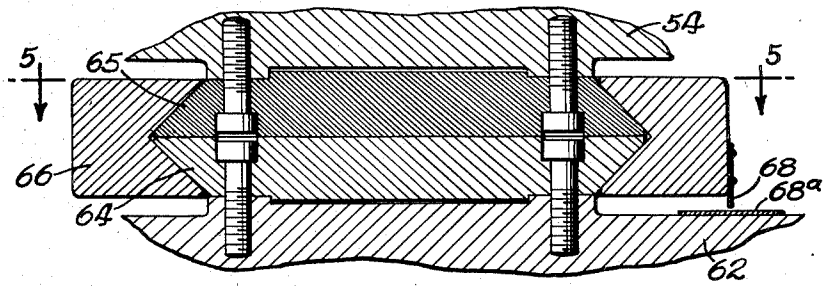


Fig. 5

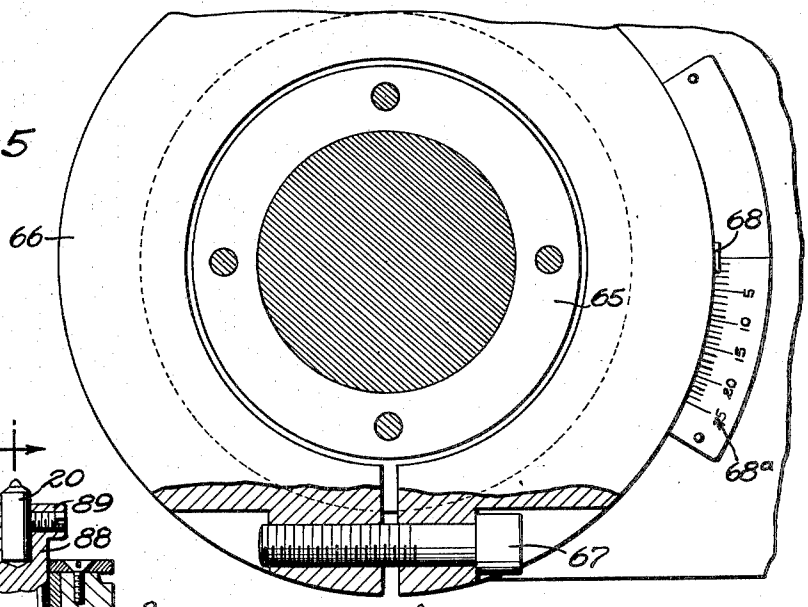


Fig. 6

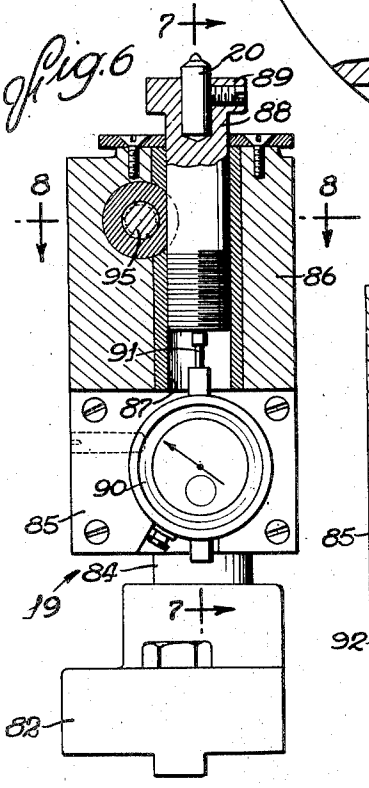
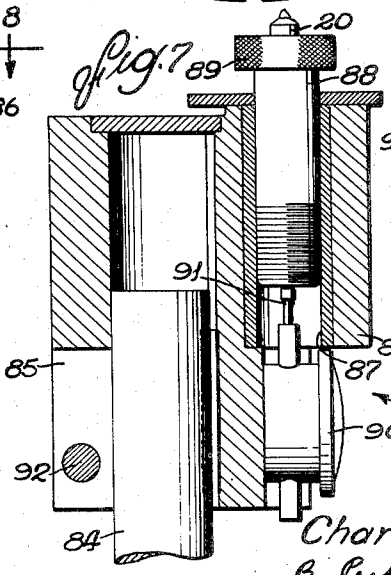


Fig. 7



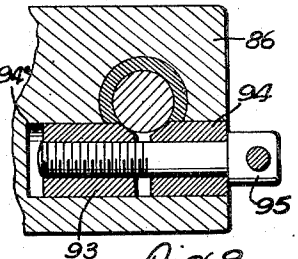


Fig. 8

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CUTTER GRINDING METHOD

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Fig. 9

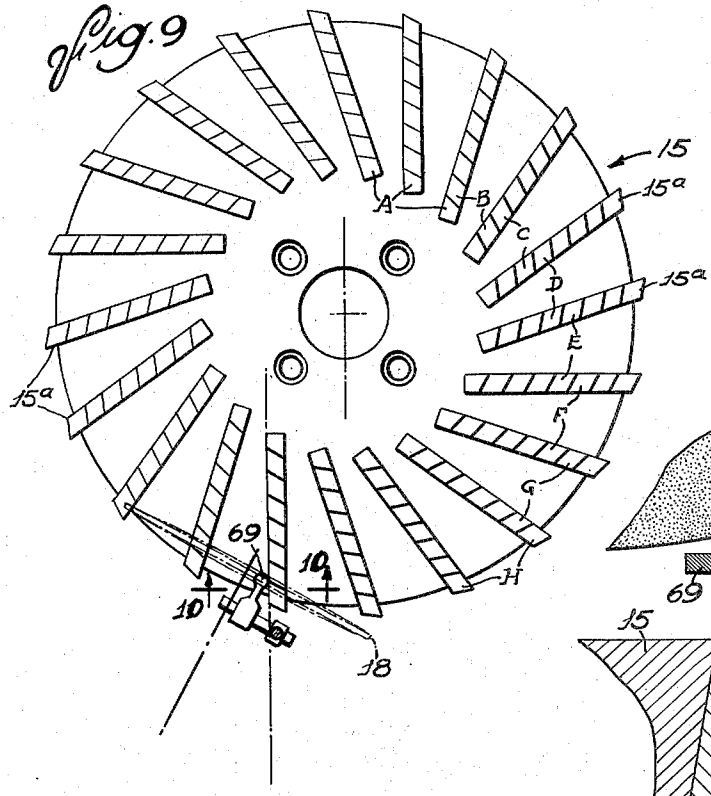


Fig. 10

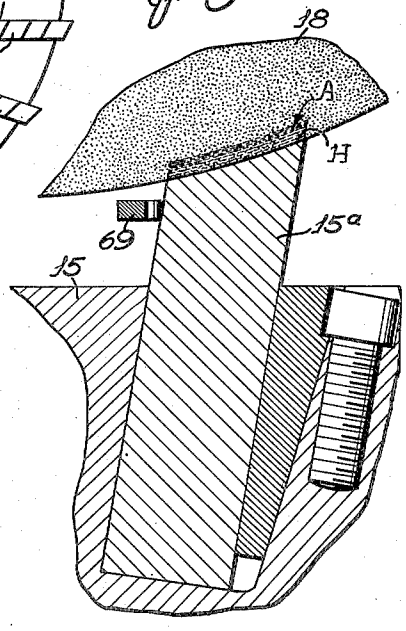


Fig. 11

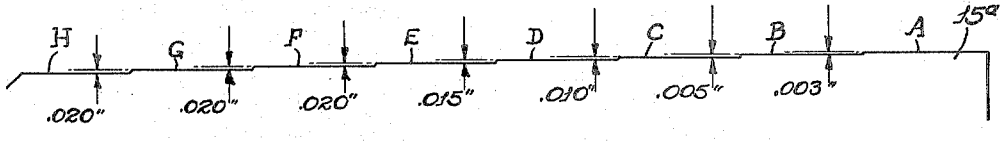
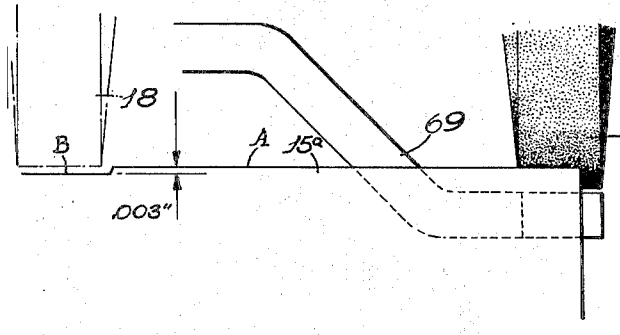


Fig. 12



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UNITED STATES PATENT OFFICE

2,238,064

CUTTER GRINDING METHOD

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Application May 16, 1938, Serial No. 208,187

6 Claims. (Cl. 51—288)

The invention relates to the art of grinding multiple blade rotary cutters adapted for face milling or boring and more particularly to an improved method of and machine for grinding cutters having blades with edges different portions of which cut to different depths during machining of a work piece.

The quality of the surface finish produced by cutters of the above type is determined principally by the accuracy and uniformity with which the finally acting or finishing edge portions of the blades are ground. More particularly, the finishing edge portions should all have the same surface characteristics, should be of uniform length, and should be correspondingly spaced with extreme precision. It is also important that the initially acting or roughing edge portions as well as the intermediate edge portions be located accurately relative to the finishing edge portions.

It has been the practice heretofore in sharpening cutters of the above general character to grind the blades successively, each blade being ground to finished form throughout its entire length before grinding the adjacent blade. It is usually necessary to dress and reset the grinding wheel after each blade is ground. The dressing and resetting introduces variations in the surface characteristics and relative positions of the different cutting edges no matter how carefully and accurately it is done. These variations, however small, tend to produce unevenness in the finished surface of the work.

The primary object of the present invention is to provide an improved method of grinding cutters of the above general character with a higher degree of accuracy than has heretofore been practical, thereby enabling the cutter to operate at maximum efficiency and to produce an extremely true smooth finished surface on the work.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a side elevation partially in section of a grinding machine adapted for grinding rotary face milling cutters in accordance with the improved method.

Fig. 2 is an end elevation of the machine with parts broken away to show details of the adjusting mechanism.

Fig. 3 is a detail view of the slide locking mechanism.

Fig. 4 is a vertical section taken along the line 4—4 of Fig. 2.

Fig. 5 is a horizontal section taken along the line 5—5 of Fig. 4.

Fig. 6 is a vertical sectional view of the grinding wheel dressing fixture.

Fig. 7 is a vertical section taken along the line 7—7 of Fig. 6.

Fig. 8 is a transverse sectional view taken along the line 8—8 of Fig. 6.

Fig. 9 is a fragmentary plan view showing the relative positioning of the grinding wheel and the cutter.

Fig. 10 is a fragmentary sectional view through one of the cutter blades and its mounting showing the grinding wheel operating on the blade.

Figs. 11 and 12 are enlarged elevational views of the edge portions of one of the cutter blades shown in Fig. 10.

While the invention is suceptible of various modifications and may be practiced in various ways, I have illustrated in the drawings and will describe here in detail the preferred embodiment and method. It is to be understood, however, that I do not intend to limit the invention by such specific disclosure but aim to cover all modifications and alternative constructions and methods falling within the spirit and scope of the invention as expressed in the appended claims.

Generally stated, the invention contemplates the provision of means for adjustably supporting a grinding wheel, a wheel dressing tool, and the cutter to be ground so that the relative position of the wheel and the edge portions of the cutter blades may be determined with a high degree of accuracy. More particularly, the various parts are so arranged that the wheel may be located with respect to a predetermined portion of the cutter as, for example, the plane of the finishing portions of the cutter blades. The grinding wheel is supported for reciprocation along the edge of one cutter blade. The dressing tool is supported at one side of the cutter being operated on and the grinding wheel is adjustable vertically and laterally to locate the active surface of the wheel very accurately with respect to the planes of the edge portions of the blades. Means is also provided for confining the relative traverse of the grinding wheel and cutter within accurately defined limits to insure uniformity in the length of the edge portions of the cutter blades.

By way of illustration, the improved method will be described as used in grinding a rotary face milling cutter of the type in which the various rows of edge portions are located in planes substantially parallel to the surface to be formed which planes are progressively stepped apart in a direction perpendicular to the surface. In the exemplary cutter, each blade is divided lengthwise into eight edge portions designated by the reference characters A, B, C, D, E, F, G, and H respectively. The corresponding edge portions are arranged in rows concentric with the axis of

the cutter with the edge portions A which take the final cut constituting the innermost row. These edge portions are referred to hereinafter as the finishing edge portions. One or more of the outermost rows of edge portions, for example, F to H, which take the first cuts are conveniently designated as roughing edge portions while the smaller steps progressing from B to E may be called the intermediate edge portions. The edge portions B—H are spaced progressively outwardly in the manner illustrated.

The improved method, as applied to the sharpening of face milling cutters, contemplates the grinding of the corresponding edge portions of all of the cutter blades, that is, the edge portions forming one of the concentric rows in a single setting of the grinding wheel, then, after resetting the wheel, grinding the edge portions of the adjacent concentric row, and so on until all of the edge portions have been ground. In this operation, the edge portions projecting farthest above the surface of the cutter, that is, the finishing portions A are preferably ground first as the accurate location of these portions is most important. The grinding wheel is set at an effective height corresponding to the edge to be formed on such portions and then passed across them individually in succession around the row without redressing or resetting the wheel. This insures formation of all cutting edges in the row precisely alike and in the same plane.

Since accurate vertical spacing of the edge portions is important in cutters of this character, it is desirable to locate the intermediate and roughing rows of edge portions with respect to the row of finishing portions. Accordingly, when the edge portions A have been ground, the grinding wheel is withdrawn for cooperation with the dressing tool. The dressing point of the tool is set so as to engage and dress the wheel lightly and then the wheel is given the final pass over the finishing portions of the blades so that the position of the dressing point will correspond exactly with the cutting edges formed of this portion of each of the blades. Very little stock is removed from the cutter blades in this operation and there is consequently substantially no wear on the wheel.

The dressing fixture is provided with a micrometer gauge, preferably of the multiplying type, which may be set to zero indication after adjustment in the manner above described, thus facilitating resetting of the wheel for grinding the next row of edge portions. Ordinarily, the edge portions of adjacent steps are spaced apart extremely small distances. In the exemplary cutter blade shown in Figs. 11 and 12 of the drawings, the edge portions B constituting the second row are spaced .003 of an inch below the cutting edge of the finishing portions. The edge portion of the succeeding rows C to H are spaced successively .005, .010, .015, and .020 of an inch below the next adjacent edge as illustrated. In order to grind the second row of edge portions B in proper relation to the finishing portions A, the point of the dressing tool is moved down the required distance, in the present instance .003 of an inch, as indicated on the micrometer scale of the tool. The dressing wheel is then lowered and passed over the dressing point, thus locating the effective grinding surface at exactly the right distance from the cutting edge formed on the previously ground portions A. The grinding wheel is then passed over the edge portions forming the second row B without changing the setting of the wheel or redressing the same. Thus, the edge portions of each blade are ground to absolute uniformity with all of these cutting edges lying in exactly the same plane entirely around the cutter.

The foregoing operations are repeated for each row of stepped edge portions, that is, the grinding wheel is accurately located by proper adjustment of the dressing tool and then the entire row of edge portions is ground without resetting or redressing the wheel. It will be understood, of course, that the rows of edge portions may be ground in the reverse order starting with the outermost row H if desired.

Referring now to Figs. 1 and 2 of the drawings, the exemplary form of the machine for carrying out the method above described comprises generally a hollow rectangular frame or base 13 having a table 14 for supporting a cutter 15 to be ground, an adjustable supporting structure 16 for supporting a reciprocable grinding head 17 in position for its grinding wheel 18 to operate on the cutter on the table 14, and a fixture 19 for holding a suitable grinding wheel dressing tool 20 in predetermined relation to the grinding wheel and cutter.

The table 14 is arranged to slide toward and from the grinding head on horizontal ways 21 on the base 13 to facilitate proper positioning of the cutter 15 relative to the grinding wheel. Movement of the table is effected, in the present instance, by a hand wheel 22 acting through the medium of a shaft 23 having keyed thereto a pinion 24 which meshes with a rack 25 rigid with the table. A locking screw 26 of conventional construction is threaded into the side of the table and acts through a shoe 27 (Fig. 3) in engagement with the ways 21 to lock the table in set position.

Referring to Fig. 9, it will be observed that the cutter 15 is equipped with a plurality of removable cutter blades 15a arranged annularly around the face of the cutter. To facilitate the presentation of the different cutter blades in operative relation to the grinding wheel 18, the cutter supporting table 14 is equipped with a rotatable fixture 28 for holding the cutter. As shown in Fig. 1, the fixture is formed with a depending cylindrical stud 29 journalled in a vertical bearing formed in the table 14 while the weight of the table is carried by anti-friction bearings 30 operating in annular raceways formed on the table and the fixture.

The supporting structure 16 is designed to provide a wide range of adjustment between the grinding wheel 18 and the table 14 to facilitate accurate positioning of the grinding wheel with respect to the cutter to be ground and to adapt the machine for grinding cutters of various types and different sizes. The structure is accordingly built up of a plurality of members adjustable one relative to the other whereby the grinding wheel may be shifted up or down and transversely of the axis of the table. The structure also includes means permitting reciprocation of the grinding head in a horizontal plane or at an angle to the horizontal while the grinding wheel may be set with its axis at any desired angle to the reciprocatory path of the head.

In the preferred form of the machine illustrated, the supporting structure 16 comprises a knee 35 slidably supported on dove-tailed vertical ways 36 formed at one end of the base 13. For raising and lowering the grinding head, the knee

is arranged to be moved by means of a hand wheel 37 fast on a horizontal shaft 38 journaled on the knee. The shaft is provided with a worm (not shown) meshing with a worm wheel 39 formed integrally with a nut 40 having a threaded connection with a rod 41 rigidly secured at its lower end to a bracket 42 projecting outwardly from the end of the base 13. Formed within the knee are spaced bearings 43 for the nut 40 which permit the nut to rotate freely but to hold it securely against endwise movement. Accordingly, the nut in rotating acts through the threaded connection with the rod 41 to raise and lower the entire supporting structure 16 and with it the grinding head 17. A clamping screw 26a similar to the locking screw 26 is available for clamping the knee in set position.

Suitable means is provided for counter-balancing the weight of the supporting structure 16 to facilitate adjustment of the same. The counterbalancing means as herein shown includes a coiled tension spring 44 adjustably anchored at one end to a bracket 44a secured to the front wall of the base 13 and at the other end to a crank arm 45 fast on a rock shaft 45a. Keyed to the rock shaft is a gear segment 46 meshing with a vertical rack 46a bolted or otherwise rigidly secured to the inner face of the knee 35. The weight of the supporting structure is thus transferred to the spring permitting the structure to be raised or lowered with a minimum of effort.

The knee 35 is formed on its upper end to provide horizontal ways 47 extending transversely of the frame of the machine. Slidable on the ways 47 is a slide 48 carrying a frame 49 which supports the grinding head 17 for reciprocation. A hand wheel 50 is arranged to move the slide on the ways to position the grinding head with respect to the cutter blade to be ground. As herein shown, the hand wheel 50 is keyed or otherwise rigidly secured to one end of a screw 51 rotatably supported on the knee and confined against endwise movement in either direction by the hand wheel and a collar 51a abutting the ends of the bearing supporting the screw. The screw cooperates wtih a nut 52 formed on the lower side of the slide to move the slide in the ways when the hand wheel 50 is turned. The slide is equipped with the usual clamping screw 26b for locking the same against movement.

Referring more particularly to Fig. 2, the frame 49 as herein shown is generally of U-shaped form and is provided at its intermediate portion with ways 53 to which is dove-tailed a slide 54 carrying the grinding head 17. The frame is preferably pivoted at its forward end to the slide 48 whereby it may be tilted to adjust the angle of the reciprocatory path of the grinding head with respect to a horizontal plane when grinding tapered or other cutters having inclined blades.

As herein shown, the pivotal support for the frame is provided by pivot pins 55 carried on brackets 55a formed on the edge of the slide 48 adjacent the table 14. Adjustment of the angular position of the frame is effected by means of a screw 56 threaded into a lug 56a on the slide and engaging with an abutment 57 formed on the underside of a transverse stiffening member 58 extending between the side portions of the frame. Formed on the side portions of the frame adjacent the rear end thereof are depending arms 59 having quadrant slots arranged to receive bolts 60 projecting laterally from brackets 61 on the slide 48. Nuts threaded onto the bolts may be tightened to clamp the frame in set position.

The grinding head 17 may be of any suitable construction and, as herein shown, includes a casing 62 enclosing a motor and suitable gearing for driving the wheel 18. A suitable guard 63 carried on the forward end of the casing 62 extends over and partially encloses the grinding wheel.

The grinding head 17 is preferably mounted on the slide 54 so as to permit the axis of the grinding wheel to be set at various angles to the axis of movement of the slide as shown in Fig. 9 to determine the clearance angle ground on the stepped edge portions of the cutter blades. For this purpose, the head is secured to the slide by means of a swivel connecting member comprising beveled edge plates 64 and 65 bolted or otherwise rigidly secured to the casing 62 and slide 54 respectively as shown in Fig. 4. The plates are arranged with their tapered edges in opposed relation and are encircled by a split clamping ring 66 having an inwardly opening V-shaped annular groove adapted to engage the edges of the plates and clamp them tightly together. Such clamping is effected, in the present instance, by means of a screw 67 arranged to draw the ends of the ring together. To facilitate accurate positioning of the head, the ring is provided with a pointer 68 cooperating with a suitable scale 68a carried on the head.

The various adjustments to position the grinding wheel relative to the cutter to be ground are all made preliminary to starting the grinding operation. When the wheel has been properly set, it is passed over the cutter blade in grinding position by reciprocating the slide 54. During this operation, the blade is held in proper relation to the grinding wheel by a finger 69 adjustably mounted on the casing 62 and having one end projecting below the grinding wheel in position to engage the side of the cutter blade as shown in Figs. 10 and 12.

The means provided for reciprocating the slide comprises, in the present instance, a chain and sprocket mechanism enclosed within the frame 49 above the slide. As herein shown, this mechanism includes a suitable chain 71 running over sprockets 75 and 73 and secured to the slide as by a bolt 74. The sprocket 75 is carried on a horizontal shaft 72 journaled on the frame structure adjacent the forward end of the slide. The sprocket 73 is carried on a slide block 76 adjustably secured to the frame structure adjacent the rear end of the slide by a screw 77. By turning the screw, the slide block and sprocket 73 may be moved toward or from the sprocket 75 to adjust the tension of the chain and thus eliminate lost motion or back-lash. Fast on the shaft 72 is a hand wheel 78 for rotating the sprocket wheel 75 and thus imparting movement to the chain 71, such movement being transferred to the head by the bolt 74 by which the chain is clamped against the slide. Thus, by rotating the wheel 78, the head may be reciprocated relative to the cutter 15 to traverse the grinding wheel 18 over the cutter blade with which it is associated.

In grinding intermediate edge portions of the cutter blades, it is necessary to confine the movements of the grinding head within accurately defined limits to prevent overrunning onto the next adjacent row of edge portions. Accordingly, novel means is provided for limiting the forward movement of the head which means is readily adjustable to condition the head for grinding successive rows of cutter edges. As

herein shown, this means comprises a stop in the form of a bar 79 dove-tailed in a horizontal slideway 80 formed in an upwardly projecting flange or bracket 81 integral with the top wall of the frame 49. The slide 54 which carries the grinding head is formed with a stop engaging member 82 adapted to engage the stop 79 and thus limit the forward movement of the slide. To facilitate accurate positioning of the stop, the bracket 81 is graduated along its upper side edge to provide a scale 83 for cooperation with a suitable index point on the stop 79.

As herein before stated, the dressing tool 20 is supported so that it may be positioned accurately with respect to the edge portions of the cutter blades 15a. In order to enable the dressing tool to operate on the grinding wheel in its various adjusted positions, the tool is supported, in the present instance, on a bracket 82 operating in a T-slot 83 formed in the upper end of the base 13 and extending transversely across the base as shown in Fig. 1. Extending upwardly from the bracket is a post 84 (Figs. 6 and 7) carrying a sleeve 85 from which projects an extension 86. The extension is formed with a vertical bore 87 threaded to receive a cutter holder 88 which carries the dressing point 20 on its upper end. The threads are preferably of very fine pitch to permit accurate adjustment of the tool by rotation of the holder. The holder 88 may be formed with a knurled collar 89 to facilitate rotation of the same. In such rotation, the cutting point is moved up or down by reason of the threaded connection provided.

Mounted on the sleeve 85 immediately below the extension 86 is an indicating micrometer 90 preferably of the resetting type having a stem or feeler 91 projecting into the bore 87 and engaging with the lower end of the holder 88. Thus, when the holder 88 is screwed into or out of the bore 87, the changes in the position of the dressing point 20 are accurately indicated.

In order to confine the movements of the holder 88 within the limits of the indicator 90, the sleeve 85 is arranged to be adjusted vertically on the post 84. The sleeve is then locked in set position by means of a suitable clamping screw 92. Means is also provided for clamping the holder 88 in set position. As shown in Fig. 8, the clamping means comprises a pair of bushings 93 and 94 axially alined in a horizontal bore 94a in the extension 86. Adjacent edges of the bushings are beveled for cooperation with the holder 88. A screw threaded into the bushing 93 and having an enlarged head 95 cooperating with the bushing 94 serves to draw the bushings together and thus clamp the holder securely in set position.

The operation of the machine in grinding a stepped face milling cutter such as the cutter 15 shown in Figs. 9 and 11 of the drawings may be described briefly as follows. The cutter is placed on the fixture 28 and secured thereto in any suitable manner. The grinding head is then positioned for operating on one of the cutter blades 15a by shifting it laterally through the operation of the hand wheel 50. The position is dependent, of course, upon the angle of the cutter blade with respect to the radial axis of the cutter and will vary with different types of cutters. In any case, the adjustment of the wheel is such that the head in its reciprocation travels in a plane parallel to the longitudinal axis of the cutter blade.

As will be noted by reference to Fig. 10, the grinding head is positioned with its axis slightly behind the cutter blade so that the wheel engages the surface of the blade at an angle to the horizontal and grinds it with the proper clearance. The particular point at which the wheel and blade engage is determined by the setting of the finger 69 and may be adjusted as required. The head is next set at the proper angle with respect to its axis of reciprocation to grind the side edges of the stepped portions with the desired clearance angle. This adjustment is made by loosening the clamping ring screw 67 and turning the head until the desired angle is indicated on the scale 68a.

Upon completion of the foregoing adjustments, the various parts are securely locked in set position and the grinding head is moved forwardly by the operation of the hand wheel 78 until the grinding wheel is in operative relation to the finishing edge portions A constituting the inner row of cutting edges. The grinding wheel is then lowered by turning the hand wheel 37 until it is in position to remove the desired amount of metal from the finishing portion of the blade and is locked in this position. The edge portion A of each blade is now ground by passing the wheel slowly over such portion. After each blade is dressed, the head is retracted and the next blade is moved into grinding position by rotating the fixture 28. The finger 69 locates the blade accurately with respect to the grinding wheel.

The above operation is repeated until all of the edge portions A have been ground to size. The grinding wheel may then be retracted and lowered slightly until it engages the dressing tool. Then, the wheel is passed over the edge portions A again, thereby taking a very light grinding cut insuring that all of the cutting edges will be ground to the precise setting of the dressing tool. The position of the wheel for grinding succeeding edge portions is determined with reference to the cutting edges of the portions A.

Upon completion of the grinding of the inner row of edge portions, the wheel is retracted and the dressing point is lowered a distance corresponding to the vertical spacing between the edge portions A and B. This distance may be determined accurately by means of the micrometer 90. The grinding wheel is then lowered and dressed with the tool in this position after which it is passed over the edge portions B of all the cutter blades.

In order to avoid overrunning onto the previously ground edge portions A and to accurately locate the edge portion B with respect to the axis of the tool, the limit of forward movement of the head 17 is determined by the setting of the stop 79. This stop is adjusted with respect to the scale 83 and securely locked in position so that during the grinding operation, movement of the grinding wheel into engagement with the previously ground edge portions is effectually prevented. At the same time, the outer sides of the edge portions A are beveled off to avoid sharp corners and are relieved to provide the necessary clearance for proper operation. The beveling action is obtained through the use of a tapered grinding wheel as shown while the clearance angle is determined by the angular adjustment of the grinding head with reference to its supporting slide.

The foregoing operations are repeated for each row of edge portions C—H until all have been ground to size. In each instance, the location of the cutting edge is determined by the setting of the dressing tool 20 which may be effected very

accurately by reason of the micrometer indicator provided. Since the dressing tool was initially set with reference to the plane of the finishing portions A, the succeeding edge portion will necessarily be properly located with respect to the first mentioned portion. Moreover, the edge portions will be of uniform length due to the action of the stop 79 which is set, of course, for each row.

The invention is applicable equally well to the sharpening of boring cutters having blades with edge portions stepped as above described to take successively deeper cuts in a work piece. For such cutters, a different fixture would be provided in order to locate the blade edges properly relative to the path of travel of the grinding wheel.

It will be apparent from the foregoing that with the improved method all of the blade edges are accurately located with reference to the finishing portions thereof and since corresponding edge portions of all the blades are ground by taking light cuts without redressing or resetting the tool, a high degree of uniformity is readily obtained. Moreover, by confining the movements of the grinding wheel within predetermined limits, the various edge portions of the blade are held to uniform length.

By reason of the wide range of adjustment, the machine may be readily adapted for grinding cutters of different types and sizes. The position of the grinding wheel may be adjusted with a high degree of accuracy so that the cutter blades may be ground to a desired contour and with absolute uniformity throughout the entire group of blades. Further, the axis of the grinding wheel may be adjusted to provide any desired degree of clearance for the lateral edges of the various cutting areas of the blade.

I claim as my invention:

1. The method of grinding a rotary cutter having blades angularly spaced around the axis with roughing and finishing edge portions arranged in rows spaced progressively along and away from the cutter axis, which comprises adjusting a grinding wheel to an effective position corresponding to that of the edges to be formed on the finishing portions of the blades, passing the wheel across the individual finishing portions successively around the entire row thereof, readjusting the wheel to an effective position corresponding to that of the roughing portions of the blades, passing the wheel across the latter portions of the blades successively around the row thereof, and dressing the wheel only when it is readjusted.

2. The method of grinding a rotary milling cutter having generally radially extending blades each divided into a plurality of edge portions arranged in rows concentric with the cutter axis and spaced apart along the axis, which comprises adjusting a grinding wheel axially of the cutter to an effective position corresponding to the edges to be formed on one of the innermost row of edge portions, passing the wheel across the individual edge portions successively around the row thereof, readjusting the wheel axially of the cutter to an effective position corresponding to the edge to be formed on the adjacent row of edge portions, and passing the wheel across the edge portions of the blades successively around said adjacent row.

3. The method of grinding a rotary cutter having blades each divided into spaced edge portions arranged in rows concentric with the cutter axis, which method comprises setting a grinding wheel in an effective position corresponding to the edges to be ground on one of the rows of edge portions, passing the wheel across all of the edge portions of said one row successively, dressing and resetting the wheel to an effective position corresponding to the edges to be ground on the adjacent row of edge portions, passing the wheel across all of the edge portions of said adjacent row successively, and similarly dressing and resetting the wheel and passing it across the edge portions of the succeeding rows.

4. The method of grinding a rotary cutter having a plurality of blades each divided into elongated spaced edge portions spaced along and from the cutter axis with the corresponding portions of the different blades arranged in a row, said method comprising adjusting a grinding wheel to an effective position corresponding to the edges to be ground on one of the terminal rows of edge portions, passing the wheel across all of the edge portions of said one row successively, readjusting the grinding wheel to an effective position corresponding to the edges to be ground on the next adjacent row of edge portions, passing the wheel across all of the edge portions of said adjacent row successively, similarly adjusting the wheel and passing it across the edge portions of succeeding rows, and dressing the wheel in each of said adjustments.

5. The method of grinding a rotary milling cutter having a plurality of blades each divided into spaced edge portions extending generally parallel to the face of the cutter with corresponding edge portions of the blades arranged in rows concentric with the cutter axis, which method comprises setting a dressing tool in an effective position corresponding to the edges to be ground on one of the rows of edge portions, passing the wheel over the dressing tool and then across all of the edge portions of said one row successively, resetting the dressing tool to an effective position corresponding to the edges to be ground on the adjacent row of edge portions, adjusting the wheel for cooperation with the dressing tool in reset position, passing the wheel over the dressing tool and thereacross all of the edge portions of said adjacent row successively, and similarly resetting the dressing tool, adjusting the wheel and passing the wheel over the tool and then over the edge portions of each succeeding row thereof.

6. The method of grinding a rotary cutter having a plurality of blades each divided into elongated spaced edge portions with corresponding edge portions of different blades arranged in rows, which method comprises adjusting a grinding wheel to an effective position corresponding to the edges to be ground on the row of edge portions which takes the final cut, passing the wheel across all of the edge portions of said one row successively, readjusting the grinding wheel to an effective position corresponding to the edges to be ground on the adjacent row of edge portions which takes the preceding cut, passing the wheel across all of the edge portions of said adjacent row successively, similarly adjusting the wheel and passing it across the edge portions of succeeding rows of edge portions until the row which takes the first cut has been ground, and dressing the wheel as a part of each adjustment.

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