May 29, 1951 W. W. WARFEL 2,554,689

ADJUSTABLE TOOL GRINDING MACHINE

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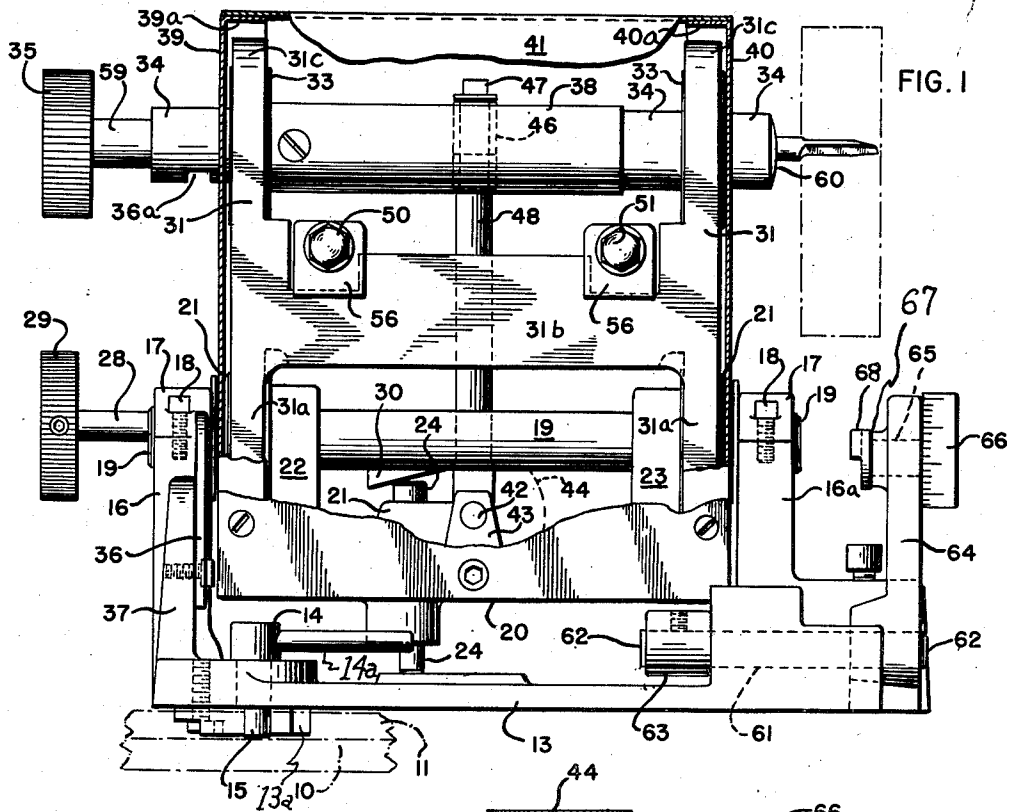


FIG. 1

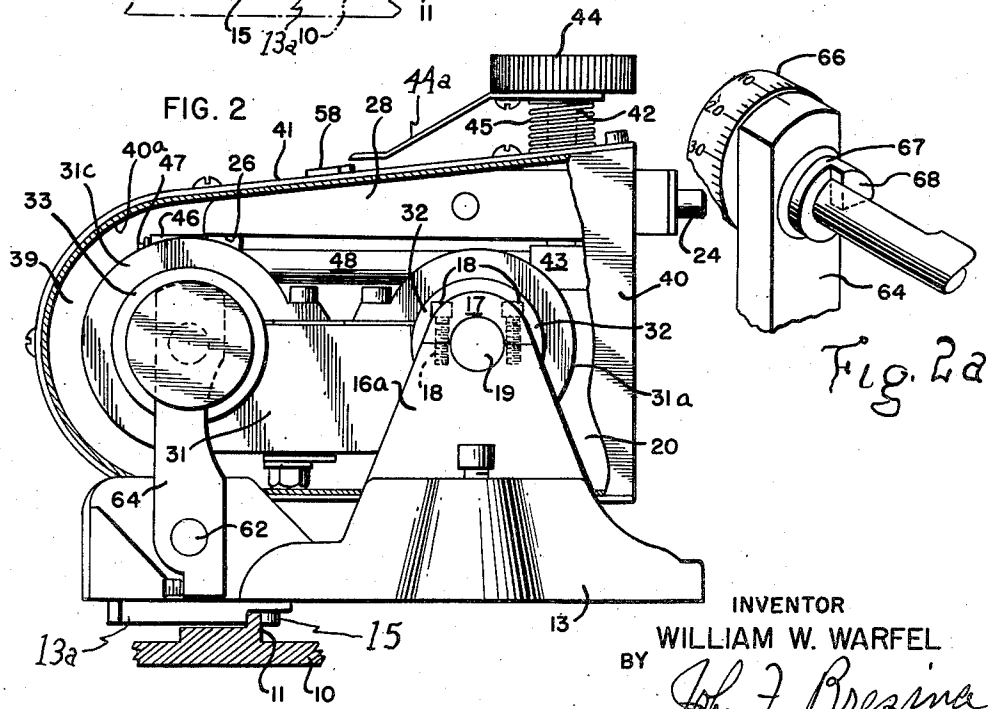


FIG. 2

Fig. 2a

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FIG. 3

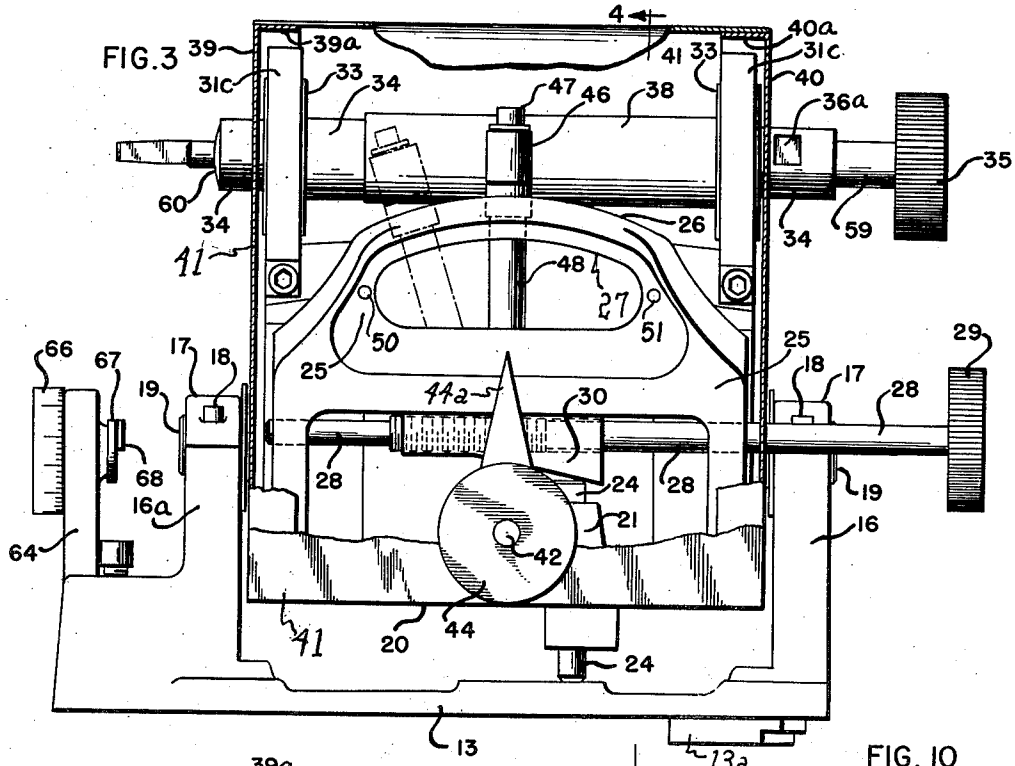


FIG. 4

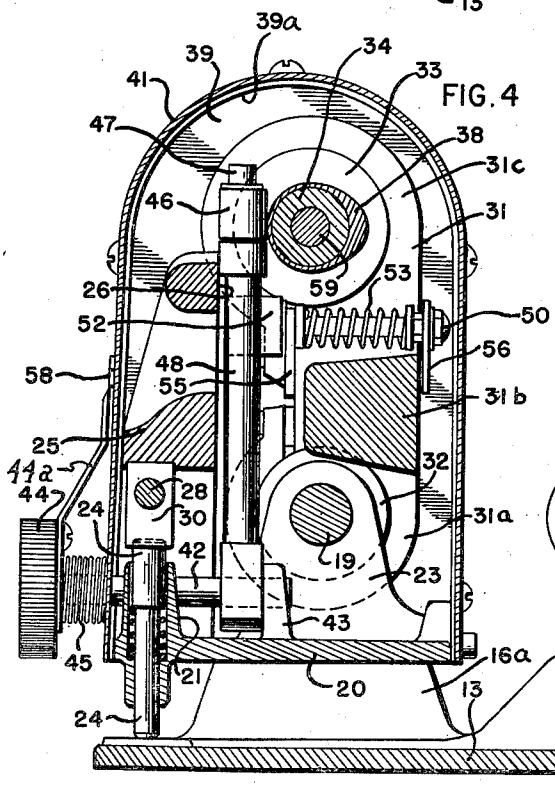


FIG. 10

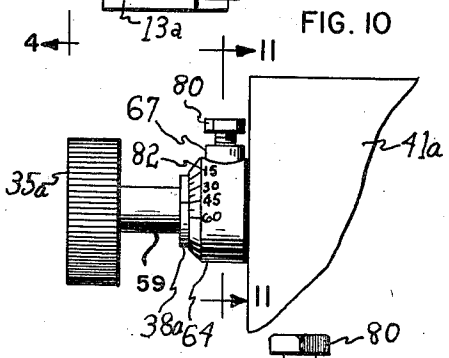
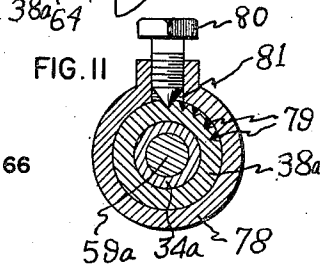
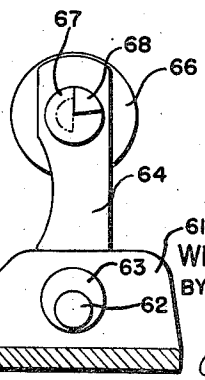


FIG. 11





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FIG. 5

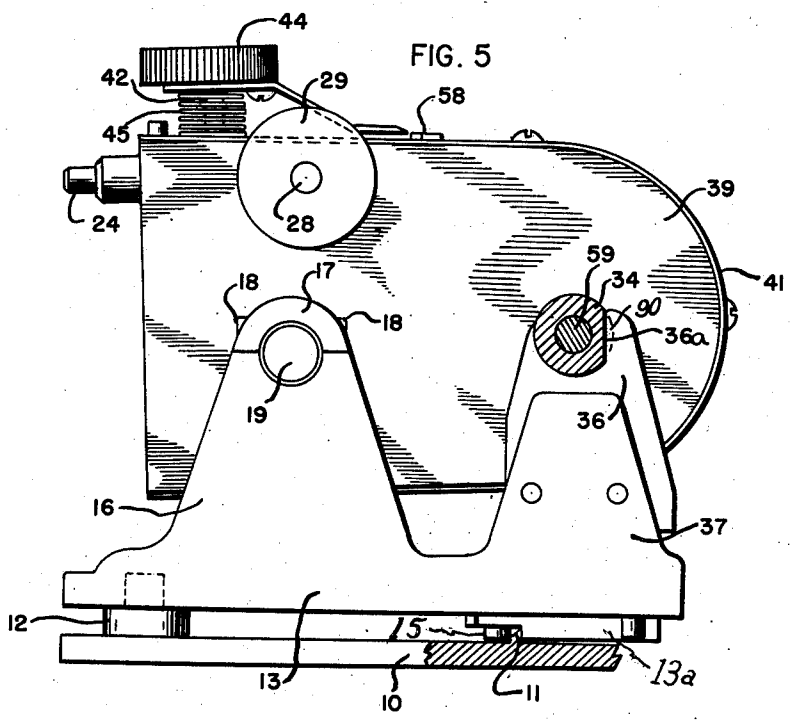


FIG. 6

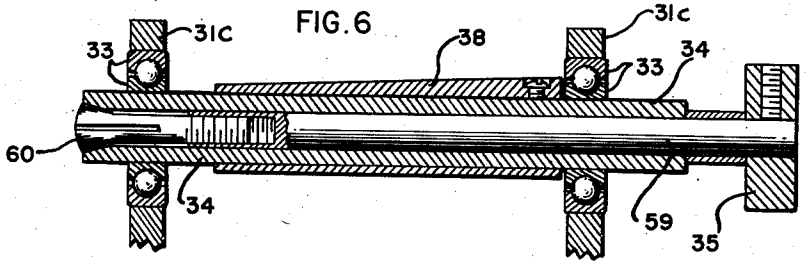


FIG. 7

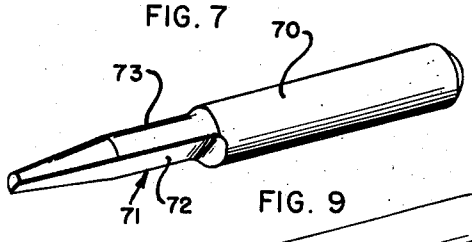


FIG. 8

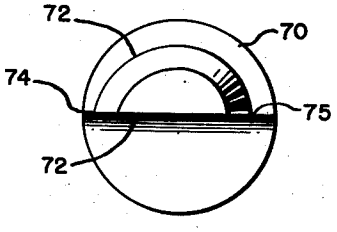
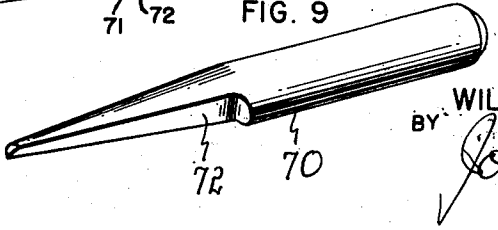


FIG. 9



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ADJUSTABLE TOOL GRINDING MACHINE

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Application January 7, 1948, Serial No. 875

11 Claims. (Cl. 51—234)

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This invention relates to adjustable devices adapted for use in mounting, holding and selectively moving and feeding router bits, drill bits and similar tools to a grinding element to be ground along arcuate or non-radial faces.

It is an important object of my invention to provide machines or adjustable gauges of the described class which include novel pivotal means for gripping and selectively setting bits to be ground; gradually tapered cam means providing for selectively rotating mounted bits during the grinding and sharpening operations thereof; adjustable means for pre-setting of said rotatable cam means so that the bit to be sharpened will be presented to and moved with respect to the grinding surface of an abrasive wheel at the proper arc and angle so that the original correct clearance without changing the face of the bit cutting parts will be maintained.

A further important object of my invention is the provision in a device of the described class of a manually adjustable mechanism which will permit variable pre-setting of the rotatable bit holding means into the proper positions and distances with respect to the abrasive wheel and which will effect variable rotation of the bits corresponding to the original curvature and clearance of the bits in order to cause the non-radial and radial surfaces of the bit to be moved uniformly and correctly during the grinding operation when the bit is rotated manually.

A further object and accomplishment of my invention is the provision of novel mechanism including a substantially cone-shaped cam shaft rotatably mounted in a pivotal frame; said cam shaft having adjustable bit gripping and holding means connected thereto; and a manually adjustable pivoted arm whose free end portion at one side normally rests against a rigid element and the opposite side of said arm end portion slidably engages the non-round surface of said cam shaft to thereby cause the cam shaft frame to pivot according to the curvature of the engaged face of said cam shaft and to provide for non-concentrically rotating a bit held in said holding means of said shaft.

It is well known that cutting and routing bits having arcuate surfaces have to be frequently re-ground in order to sharpen the cutting edges thereof. Grinding by merely hand gripping the bits is unsatisfactory as is also rotating such bits in a rotatable jig because this grinds away the bit stock unevenly and changes and ruins the original arcuate surface or clearance with the result that very poor and unsatisfactory cut-

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ting and short life of bits result. Especially with bits having non-concentric rounded faces to be ground it has been extremely difficult and often impossible for even expert machinists to grind away correctly the non-concentric portions of such bits to maintain a correct clearance for the material being cut. This difficult problem of correctly grinding non-concentric surfaces either of bits or other machine parts is entirely eliminated with my novel mechanism as will more fully hereinafter appear.

A still further object and accomplishment of my invention is the provision of a manually adjustable tool gripping pre-shetting and clearance-adjusting means having an indicia-bearing disk thereon which provides for swinging said means against the flat face of the cutting end of a bit, measuring the angle of the flat face thereof with respect to the "rake" and thence mounting the bit into the holding means at a different angle to the grinding wheel so that it may be accurately ground to change the original clearance to the desired degree.

Other and further important objects of the invention will be apparent from the following description and accompanying drawings.

On the drawings:

Fig. 1 is an elevational view with parts broken away and looking at the side of the device on which the operator is positioned.

Fig. 2 is an end view looking at the right hand end of Fig. 1 and with the device tilted down and in normal position when the bit is set and locked into the collet.

Fig. 2a is an enlarged perspective view of part of the adjusting means for presetting the bits and shown in the elevation at the left of Fig. 3.

Fig. 3 is an elevation looking at the side of the device opposite to the side shown in Feg. 1 and with the same in upright position.

Fig. 4 is a partially cross-sectional view taken on a plane indicated by line 4—4 of Fig. 3.

Fig. 5 is an end view looking at the end of the device shown at the left of Fig. 1, and with the shaft of the cam means in cross-section.

Fig. 6 is a cross-sectional view of the chuck, collet and cam member and rotating means therefor.

Fig. 7 is a perspective of a typical routing bit whose reduced end portion is adapted to be ground on said device.

Fig. 8 is an end view of a routing bit showing a typical non-radial face to be ground.

Fig. 9 is a perspective view of another type

of routing bit, such as may be re-ground with my device.

Fig. 10 is an enlarged view of the end portion of the shaft which carries the cam and having a graduated bit adjusting and presetting means thereon.

Fig. 11 is a cross-section taken on line 11—11 of Fig. 10.

Referring to Figs. 1, 2 and 5, numeral 10 designates a pivotally mounted metal shelf or base, which is mounted upon any stationary support (not shown) adjacent a grinding machine and abrasive wheel. Said shelf or support 10 carries an arcuate flange 11 which is preferably integral with shelf 10 and which is disposed radially with respect to pivot or post 12 on which my device is swivelly mounted with respect to said shelf.

Numeral 13 designates a metal base which is swingably pivoted for horizontal movement on pivot post 12. Post 12 is secured to shelf 10. Base 13 has an integral apertured crank lever or post 14 (Fig. 1) on the upper end of which a crank lever 14a is secured. The lower projecting end of said post has an integral cam 15, which when rotated to certain positions will engage the side face of flange 11 to lock the device in desired position with respect to the shelf particularly during the grinding operation. Numeral 13a designates a spacer block or flange which is carried by or is integral with base 13.

Base 13 has a pair of integral upwardly extending journalling extensions 16 and 16a recessed at their upper ends and journalling blocks 17 are removably secured by screws 18 to provide journalling boxes for the opposite end portions of metal shaft 19.

As shown in Figs. 1, 2 and 4, a metal frame or cradle 20 of substantially U-shaped form has a pair of aligned holes in the opposite upwardly extending end lugs 22 and 23 thereof which journal on said shaft. Said cradle 20 is rockably mounted on and supported by shaft 19. Referring to Fig. 3, the central part of said cradle has an upwardly exending rear side passaged boss or lug 21 in which is slidably mounted a thrust pin 24 whose lower end normally engages the upper face of the shelf 10. As shown in Fig. 3, cradle 20 carries an upwardly extending member 25 whose upper end portion forms a guide or track 26 which faces inwardly of the unit for a purpose hereinafter described. Member 25 preferably has an enlarged slot 27 as indicated. Said member 25 has journalled in aligned passages in the opposite ends thereof a manually rotatable shaft 28 which has a knurled hand wheel 29 on the projecting end thereof.

The intermediate portion of shaft 28 is threaded and has threadingly mounted thereon a block 30 whose lower face is inclined as shown and which face normally engages the upper end of pin 24. It will be understood that rotation of the shaft 28 in counterclockwise direction will move the block 30 to the left and counter movement will move said block to the right. When said block is moved to the left the cradle and parts thereby supported are moved away from the viewer of Fig. 3 and consequently the bit hereinafter described may be gradually moved closer to the grinding wheel as the grinding operation progresses. This means constitutes a manually controlled means for moving the bit toward or away from the abrasive wheel.

Referring to Fig. 1, numeral 31 designates a substantially U-shaped metal frame whose lower vertically disposed projecting end portions have a pair of aligned apertures in which are mounted a pair of bearings 32, one of which is shown in Fig. 2, said bearings being journalled on the end portions of shaft 19 immediately adjacent the extensions 22 and 23 respectively. Said frame 31 has an intermediate integral connecting bar 31b as shown in Fig. 1.

The upper portions 31c of frame 31 have mounted therein a pair of ball bearings 33 as shown in which is rotatably mounted the cam shaft 34, as shown in Figs. 1, 3 and 6.

One end of passaged cam shaft 34 projects beyond one of the frame portions 31c and has rotatably mounted therein an inner shaft 59 which carries a knurled wheel 35 secured thereon. As shown in Fig. 6, the inner end of shaft 59 has a threaded passage in which is threaded the inner end of the collet 60 in which the butt end of bit to be ground is adapted to be releasably mounted. Said extending portion of cam shaft 34 has a recess 36a therein to provide for seating thereof into a recessed locking plate 36 which is secured by screws or the like in upwardly extending position to a boss 37 formed integral with base 13 as shown in Fig. 5 and at the left of Fig. 1.

The intermediate portion of shaft 34 has mounted thereon a metal sleeve or cylinder 38 (see Fig. 4) whose cam surface is gradually reduced from one end portion thereof to the other. The opposite ends of shaft 34 extend through transversevly extending slots 90 in the metal end plates 39 and 40, one of which slots is partially shown in Fig. 5. Said end plates form part of the outer housing of the unit and the same have angularly bent apertured edge flanges 39a and 40a respectively, which facilitate mounting of a U-shaped metal hood 41 which is partially shown in end view in Fig. 5 and in partial section in Fig. 3.

As shown in Figs. 1, 3 and 4 boss or lug 21 has a horizontal passage in which is journaled a short shaft 42. The base or frame 20 carries on its lower end an inner passaged boss 43 whose passage is in alignment with the passage of boss 21 and the inner end of shaft 42 is also journaled in said passage of boss 43, as well as in boss 21.

As shown in Figs. 3 and 4 the outer projecting reduced end of shaft 42 carries a knurled wheel or handle 44 and a friction spring 45 is mounted between wheel 44 and the shell or hood 41 for the purpose of causing the said wheel and shaft to remain into whatever position it is set and to assist in maintaining engagement between thrust bearing 46 and the arcuate side facing track 26. Numeral 44A designates a pointed indicating arm which is connected to shaft 42 and handle 44. Its upper point moves along numbered markings 58 on shell or hood 41. A metal adjusting lever or arm 48 is secured on the inner end of portion of shaft 42 as shown in Fig. 4 and the same extends upwardly and has rotatably mounted on its upper end a metal sleeve or thrust bearing 46 which is secured in position by nut 47.

The lower portion of thrust bearing 46 slides or engages track 26 (Fig. 4) in which engagement it is maintained with the aid of springs 53. Opposite to track 26, bearing 46 slidably engages the cam face of cylinder or cam sleeve 38.

A pair of threaded bolts 50 and 51 have one end of each thereof mounted in member 25 at opposite ends of track 26. Passaged spacers 52 are slidably mounted in said bolts respectively adja-

cent said track 26. Said bolts 50 and 51 have mounted thereon expansion springs 53, only one of which is shown in Fig. 4 and which thrust against two recessed thrust plates 55 respectively, which plates are suitably secured against the side face of cross arm 31b of frame 31. The normally outer ends of said bolts have depending metal stop members 56 secured thereon by suitable lock nuts which limit the rocking movement of frame 31 in one direction.

It will be understood that as frame 31 is rockable about bearings on shaft 19, the partial rotation of the cam sleeve 38 (which slides against bearing 46) will cause a rocking movement of frame 31 and shaft 34 which rocking movement compresses the springs 53, and that as the cam is moved beyond maximum projection of the cam face the springs 53 move said frame 31 (with shaft 34) in a direction toward bearing 46 and track 26. The result is a substantially horizontal adjustable though arcuate movement of the shaft 34 with its bit holding means herein described. The extent of such movement in substantially horizontal direction is manually controlled according to the degree that the user rotates shaft 34 and wheel 35, and the length and path of such movement is changeable according to the position to which bearing 46 and arm 48 are positioned manually. To facilitate proper presetting for the particular size and curvature of bit being ground, a plurality of radially spaced markings 58, with number indicia are preferably provided on the shell or hood 41 and part of which are shown in Figs. 2 and 5.

Referring to Figs. 10 and 11 which illustrate a modified form of my invention, numeral 78 designates a metal collar which is adjustably mounted on the projecting end portion of the cam cylinder 38a which projects through hood 41a. Cam cylinder 38a has a plurality of adjacent recesses 79 formed thereon as shown in Figure 11. A screw 80 is threaded in a threaded passage 81 of the boss 82 of collar 78. Collar 78 bears spaced graduations and indicia 82 as shown in Figure 10. Only part of the numbered markings are shown in Figure 10. These indicia and markings are preferably in relation to one-thousands of an inch. A suitable mark (not shown) is placed on the end wall of hood 41a, which is closest to the handle 35a and substantially opposite the lowest number of the indicia 82, for example zero. The extent of manual rotation of handle 35a, shaft 59a, cam cylinder 34a, cam 38, and a bit mounted in the collet can be observed by the operator who can thereby regulate and limit the extent of such rocking movement to the desired degree.

As shown in Figs. 1 and 3, the base 13 has an integral upwardly extending boss 61 which has a horizontal bore or passage therein indicated in dotted lines at the right in Fig. 1. A horizontal stub shaft 62 is journaled in said passage and a metal adjusting pre-setting arm 64 is securely mounted on its outer projecting end, and a retaining collar 63 is secured on its inner end.

As shown in Figure 2a, pre-setting arm 64 has journaled in an upper passage thereof a stub shaft 65, shown in dotted lines in Fig. 1, and an indicia-bearing graduated wheel 66 is mounted on its outer end. On its inner end shaft 65 carries an annular pre-setting member 67 which has two flat side faces which join in an apex as indicated in Figure 2. The upper end of arm 64 has a mark therein as indicated at the upper right of Fig. 2, with which the graduations of wheel 66 are adapted to be registered.

In Figs. 7 and 8, I illustrate a typical routing bit 70 having a reduced end portion 71 defined by a flat surface 72 and curved surface 73. Portion 71 is non-axial with the shank of bit 70. The angle of surfaces 72 and 73 comprise the "rake" and their juncture comprises the cutting edge 74 which requires periodic re-sharpening which has to be accomplished by grinding away the curved face 73. This necessitates the substantially uniform rotation of the bit during grinding and as the bit is rotated (during grinding) to an extent where the abrasive action has reached the cutting edge, the bit has to be moved away from the grinding wheel so that the annular surface beginning at edge 75 will meet the face of the grinding wheel properly and so that the annular face from 75 to the cutting edge will be ground uniformly and to the same extent and without changing the angle of the rake of the bit. Accomplishment of correct grinding of such a non-axial annular bit face by hand gripping of the bit is extremely difficult and seldom accomplished, as practically all grinding by hand gripping results in taking off the metal stock non-uniformly and in changing the angle of the rake, with the result of inefficient routing and short life of bits.

It is to be understood that when the operator desires to set my novel device the graduated wheel 66 is set to the desired angle by getting one of the graduated marks aligned with the mark on the upper end of the arm 64 and the device is set as illustrated in Fig. 2a. The cradle 20 is then elevated to an upright position so that the track 26 abuts against the thrust bearing 46 which has been set at the desired predetermined position by the operator along the cylinder 38, said last mentioned adjustment being brought about by the desired movement of the handle 44 with the consequent setting of the lever 48. As the shaft 59 rotates, it will be seen that the frame 31 will be caused to rock and that the grinding will occur uniformly and as predetermined by the operator, both as to the angle of the grinding desired and the amount of material removed. Figs. 2 and 5 show the device in a work positioning set-up.

As many changes could be made in the above construction, and as many apparently widely different embodiments of my invention, within the scope of the claims could be constructed without departing from the spirit or scope thereof, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a device of the described class, a movable base member; a cradle pivotally connected to said base member; a U-shaped metal frame within said cradle, pivotally connected at its lower end portion with respect to said cradle and adapted to rock transversely therein; a manually rotatable shaft journaled in the upper portions of said frame; releasable bit gripping means on one end of said shaft; an elongated tapered cam on said shaft; an adjustable means operatively connected to said cradle and normally slidably engaging said cam, said adjustable means being adapted to permit variation in the length of the rocking movement of said cam by the varied adjustment thereof along said cam, the rotation of said cam being adapted to rock transversely the upper portion of said frame and to move said shaft and cam in a generally horizontal direction; and a spring means operatively connected to said frame and connected to the upper portion of said cradle

for moving the frame and shaft in one direction and for maintaining a sliding contact between said cam and said adjustable means.

2. In a device adapted to be adjustably mounted with respect to a grinding wheel; a base having upwardly extending journaling elements; a transverse shaft mounted in said journaling elements; a cradle rockably mounted on said shaft; a substantially U-shaped frame having apertured depending extensions journaled on said shaft and having upwardly extending bearing supports; an elongated tapered cam shaft journaled in the upper portions of said frame; an adjustable bit-holding means carried by said cam shaft; a transversely extending track member carried by said cradle; a manually adjustable arm pivoted with respect to said cradle and having one portion thereof normally slidably engaging said track member and normally engaging the cam surface; and spring means connecting the upper portion of said cradle and the intermediate portion of said frame for maintaining said cam surface in sliding contact with said arm and for effecting substantially horizontal movement of said cam shaft and of the upper portion of said frame; the length of rocking movement of said shaft being adjustable by changes of position of said arm.

3. In a device adapted to be adjustably mounted with respect to a grinding wheel; a base having upwardly extending journaling elements; a transverse shaft mounted in said journaling elements; a cradle rockably mounted on said shaft and between said elements; a substantially U-shaped frame journaled on said shaft and having upwardly extending bearing supports; an elongated tapered cam shaft journaled in the upper portions of said frame; an adjustable bit-holding means connected to said cam shaft; a transversely extending track member carried by said cradle; a manually adjustable arm pivotally connected to said cradle and having one portion thereof normally slidably engaging said track member and normally engaging the surface of the cam shaft; a graduated member for indicating the position of said arm; and spring means connecting the upper portion of said cradle and the intermediate portion of said frame for maintaining said cam shaft in sliding contact with said arm and for effecting substantially horizontal movement of said cam shaft and of the upper portion of said frame; the limits of the transverse movement of said cam shaft being adjustable by changes of position of said arm with respect to the surface of said cam shaft.

4. In a device adapted to be adjustably mounted for movement with respect to a grinding wheel a base having upwardly extending journaling elements; a transverse shaft mounted in said journaling elements; a cradle swingably mounted on said shaft; a substantially U-shaped frame journaled on said transverse shaft; an elongated longitudinally tapered cam shaft journaled in the upper portions of said frame; an adjustable bit-holding means on said cam shaft; supported manually adjustable means in slidable engagement on the cam shaft and being movable longitudinally of said cam shaft to thereby cause a substantially and varied horizontal movement of said frame, cam shaft and bit holding means; and spring means connecting said cradle and said frame for maintaining said cam shaft in sliding contact with said adjustable means; the transverse movement of said cam shaft being adjustable by said adjustable means.

5. In a manually operable device for holding, rotating and moving a cutting bit toward and away from a moving grinding surface; a base adapted to pivot on a stationary support; pivoted supporting means on said base; an elongated tapered cam shaft journalled on said supporting means; means on said cam shaft for holding a cutting bit; and supported adjustable mechanism adjustably engaging said tapered cam shaft longitudinally of said cam shaft and for moving said pivoted supporting means in a substantially and varied horizontal direction to provide for selectively presenting portions of a rounded bit surface to be ground into grinding engagement and also for preventing such engagement of other parts of said bit, the adjustment of said adjustable mechanism being adapted to adjust the length of the rocking stroke of said pivoted supporting means.

6. A device as described in claim 5 and having means for releasably locking said base in desired position with respect to a grinding wheel.

7. In a device for holding and moving a cutting bit in a non-concentric path; A rockably mounted supporting means; an elongated gradually reduced cam journalled in said supporting means; means on said cam for holding a tool; adjustable means operatively connected to said supporting means and being in slidable engagement with said cam along the length thereof and adapted to provide for rocking movement of said supporting means and said shaft whereby selected portions of a gripped tool will be advanced to permit gradual engagement thereof with a movable grinding wheel, the length of the rocking movement of said cam being adjustable by changes of position of said adjustable means longitudinally of said cam.

8. In combination, a device as recited in claim 5; a mechanism including an arm pivotally connected on said base, a manually rotatable and adjustable mechanism journaled in the outer end of said arm, said mechanism having an angularly faced shaft adapted to be pre-set to coincide with the flat face of a routing bit, said last mechanism providing for selectively pre-setting cutting bits into desired and predetermined position in said bit holding means so that such bits can be ground with a predetermined and correct rake.

9. A device as recited in claim 5, wherein said cam shaft is gradually tapered from one end toward the other, and wherein said adjustable mechanism includes a movable arm normally engaging said cam shaft, said arm being adapted to provide for predetermined presetting of said pivoted supporting means with respect to said cam shaft and being adapted to provide for predetermined non-axial rotation of the bit holding means and of a bit mounted therein so as to permit presentation of a non-round surface of such bit to a movable grinding surface and for a predetermined rocking stroke of said supporting means.

10. In a device for holding routing bits or the like and providing means for rocking such bits in a predetermined arcuate path during grinding thereof; a base, a pair of spaced supports on said base; a frame member pivotally connected at its lower portion to said supports; a flat side face on the upper portion of said frame member; an adjustable pivoted arm supported by said frame and normally engaging said side face; a transverse manually rotatable shaft journalled in the upper part of said frame member; means for releasably holding a tool or bit at the end of said

shaft; and a cam cylinder gradually tapered longitudinally and mounted on said shaft, and being selectively engageable along the length thereof by said pivoted arm; the movement of said adjustable pivoting arm being adapted to vary the distance between said side surface of said frame member and the longitudinal axis of said cam-carrying shaft whereby different and varying curved paths of movement are achieved and a tool mounted at the end of said shaft may be effected so that tool surfaces non-concentric with the axis of the tool may be correctly ground.

11. A device as described in claim 10 having a manually adjustable means for predetermining the rake of a bit to be ground and providing for measuring intermittently during grinding of the angle and rake of a bit mounted in the bit holding means; and having manually controlled means for said frame and parts carried thereby adapted to slowly feed the held tool into engagement with a grinding wheel.

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