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END MILL SHARPENING FIXTURE

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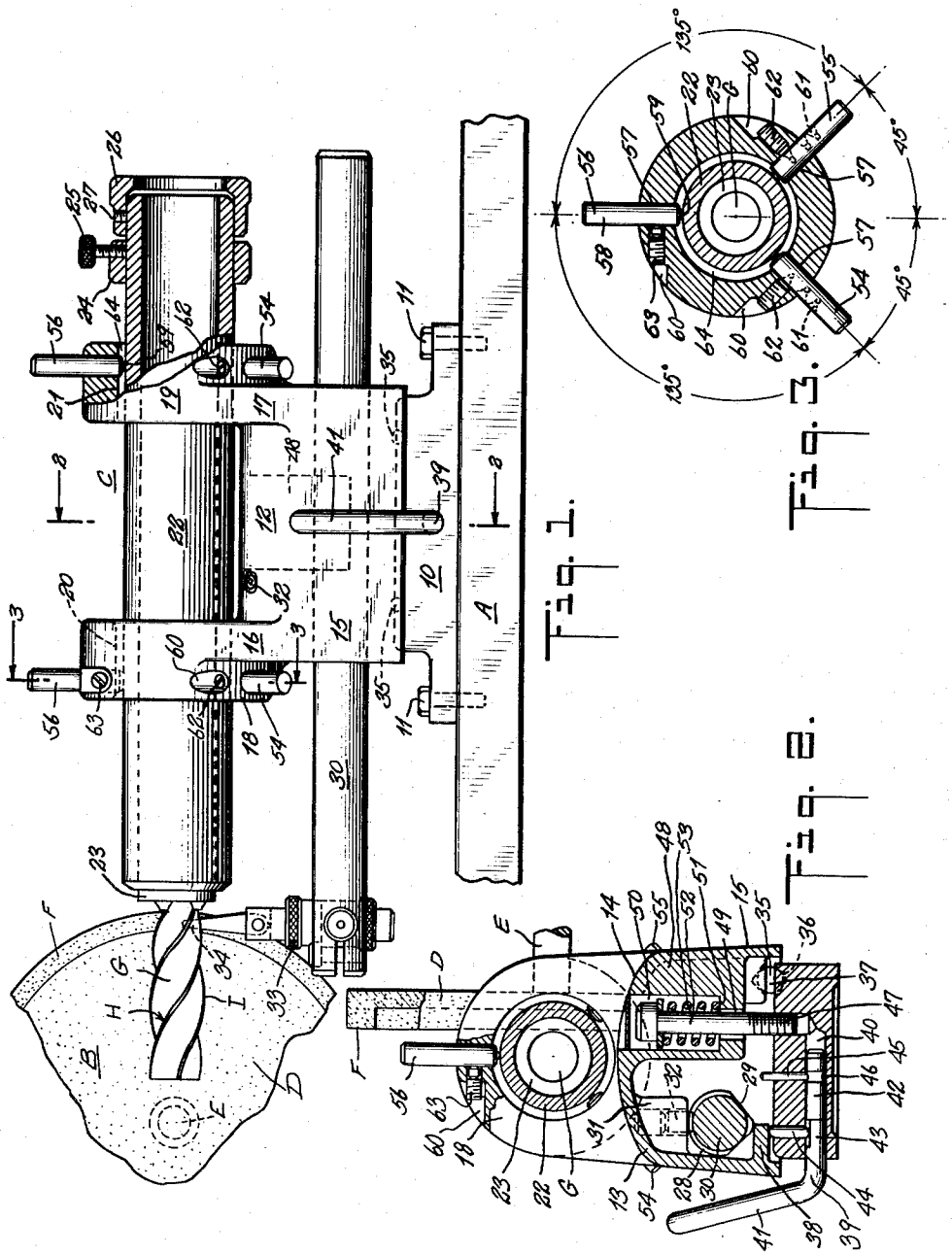


Fig. 1.

Fig. 3.

Fig. 2.

INVENTOR.
CARL J. HERTLEIN
BY
Warren S. Orton
ATTORNEY

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END MILL SHARPENING FIXTURE

Carl J. Hertlein, Bronxville, N. Y.

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1

The invention relates in general to a work holder for mounting a piece of work relative to a tool or similar device for machining the same, and specifically relates to an attachment to a grinding machine and operative to advance and withdraw a spiral fluted end mill or similar spirally grooved tool to and from a grinding device for sharpening the cutting edges of the mill or tool.

In grinding machine attachments of this type it is known to mount the mill or tool to be ground in the recessed end of a solid spindle which in turn is mounted either directly in a rugged grinding head or in a massive bearing in turn mounted in the head. In such devices the head also carries one end of a finger bar, the other end of which carries a guide finger which engages in the spiral of the tool to rotate the same as the tool holder is manually fed in one direction towards the grinding device. In such known devices the head is mounted for rocking movement about an axis in the longitudinal medial plane of the device and is arranged so that the spiral portion of the tool which has been rotated by the guide finger relative to the grinding surface during the feeding movement tends to leave the guide finger upon the return movement of the tool and the head is pivoted as so to turn away from the grinding surface and thereby allow the tool with its previously ground spiral cutting edge to be returned to its initial feeding position without being damaged by contacting the grinding surface of the grinder.

In such device if the friction between the tool-carrying spindle and its bearing is too great the tool carried by the spindle of course will not rotate freely if at all, and this causes the cutting edge to be damaged by the grinding wheel and this possibility of damaging the tool will also occur if there is too much play between the spindle and its bearing. Because of the close fitting between the spindle and its long bearing in known devices a little dust or emery collecting in the bearing and even the presence of a little too much oil can defeat the desired accuracy in grinding and otherwise give trouble. Further, in such known devices a great deal of heat is generated at the point of grinding and this heat is transmitted through the solid spindle to its bearing, causing variable periods of both expansion and contraction of both the spindle and its bearing with resulting difficulty in shifting the spindle under conditions where, on the contrary, a freedom of spindle movement is vitally necessary to the proper grinding of the tool.

2

Further, in such devices the spindle wears down and its bearing is enlarged, with resulting looseness in the desired close interfitting of the parts. No practical solution has been offered to compensate for this eventual looseness of the interengaging parts between the tool spindle and its bearing.

Among the objects of the invention are to provide a form of mounting for the work-carrying spindle which will tend to minimize the transference of heat to the spindle bearing; which will tend to avoid storing of heat in solid parts of large heat storing capacity; which will provide for an extensive air-cooled area to the spindle, both exteriorly and interiorly; and which will provide for an air-cooling of the spindle mounting and associated bearing; and in which a wearing away of interengaging parts can be compensated for and the coaxial relation of the parts easily restored.

Broadly, these objectives are attained in several ways, as by forming the spindle hollow with one end open to the outside air; by mounting the spindle in a pair of spaced-apart air-cooled heads forming the top of a pair of upstanding standards also exposed for air-cooling; by supporting the part of the spindle in each head on a cradle formed of two points of limited spindle-engaging area and disposed to center the spindle in its support and incidentally to form annular air spaces between the spindle and the heads and which air spaces are open at opposite ends to the cooling effect of the external atmosphere. The invention particularly features the point suspension of the tool spindle in space to minimize the frictional resistance to the desired freedom of movement of the spindle; to expose as much of the spindle as possible to the cooling effects of the environmental air; and to utilize the rotating spindle as a blower to pass air through the free spaces between the spindle and its mounting and to sweep away any dust, dirt or other foreign matter which otherwise might tend to collect on the cradle-forming points.

Another object of the invention is to provide a form of bearing for the finger bar, usually employed in such devices, which bearing will tend to fix the spiral-engaging finger carried by the bar rigidly in whatever place it may be set for the time being and in this way at least tend to defeat the setting up of vibration in the finger.

The disclosure features a structure designed to provide rigidity between the finger bar and a rugged part of the tiltable body in which the spindle is journaled. Broadly, this objective is

attained by providing in the rockable body herein featured a mounting for the finger bar which mounting will engage the bar at two widely separated points in its length; which points will be rigidly tied together by a structural part of the body and in which opposite ends of the finger bar will be in effect balanced on its support and locked thereto in such way as will tend to neutralize vibration which may be set up therein by reason of the rotating tool engaging the finger.

In so far as the tiltable body is concerned, an object of the invention is to provide an extremely strong, rigid body capable of functioning as required of such devices, but made up of the least possible amount of metal and that material distributed where it is most effective.

Broadly, this objective is attained by designing the body for the most part as a hollow structure, internally braced in those parts which are intended to carry loaded or strain-resisting parts while leaving non-strain-carrying parts of least cross-section of material.

Still another object of the invention is to provide for an easily manipulated control for the tilting of the body, its spindle and the tool carried thereby to be ground relative to the grinding device; arranged so that simply by tilting a hand lever in one direction the tool is brought into proper pre-set relation to the grinding wheel to be sharpened thereby, and by tilting the lever back into its initial position the tool is moved into an inoperative position and locked in such position in offset relation to the grinding wheel so that the tool can be returned freely to its initial position without possibility of being damaged by the grinding wheel.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of device embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings—

Fig. 1 is a view in side elevation partly in section of an attachment constituting a preferred embodiment of the invention shown carrying an end mill in position about to be advanced into engagement with a grinding wheel;

Figs. 2 and 3 are each transverse sectional views taken, respectively, on lines 2—2 and 3—3 of Fig. 1 looking in the direction indicated by the arrows.

In the drawings and referring first to Fig. 1, there is disclosed a support A on which is mounted a grinding device B and an attachment C particularly forming the subject matter of this disclosure. The grinding device includes a grinding wheel D rotated by means of a grinding wheel shaft E and includes an annular grinding face F. The attachment carries a fluted end mill G or similar tool to be ground and the mill is provided with a longitudinal spiral H and a cutting edge I.

Mounted on the support A and forming the bottom of the attachment is a longitudinally extending solid block forming a base 10 and which base is secured to the support by bolts 11. Mounted on the base is a casting preferably a steel casting, forming a rockable body 12. The body includes a hollow shell or foot 13 which is formed of a curved top wall 14 rounding into depending side walls 15. These walls coact to form a mutually braced structure capable of withstanding the strains to which such devices are subjected in use, even though the parts thereof not intended to transmit strains or to carry screws and the like are of thin cross section of material. Projecting integrally from opposite ends of the body 12 is a pair of standard forming uprights forming a forward standard 16 and a rear standard 17. Each of the standards includes a short tubular barrel-like upper portion which forms a forward head 18 and a rear head 19. These heads are provided, respectively, with relatively large bearing apertures 20 and 21 disposed in axial alignment longitudinally of the device. These apertures do not have to be carefully machined as they do not form bearings. Mounted in the apertures by means hereinafter described is a long hollow steel tube open at opposite ends and providing a tool-carrying spindle 22. It is a feature of this disclosure that the spindle is exposed between the standards and at its opposite ends to the cooling effect of the external air. At its forward end, that is, at the end nearest the grinding wheel, the bore of the spindle is fashioned to receive the tool G or, if the tool is of smaller diameter than the bore, to receive a tool bushing 23 in which the small tool is fitted. At its opposite end, that is, the end beyond the rear head 19, there is slidably mounted on the spindle an annular ring forming a stop collar 24 which is adjustably fixed in place by means of a set screw 25. This collar is set to limit the feeding movement of the tool toward the grinding wheel D. The extreme outer right end of the spindle is provided with a knurled knob 26 secured to the spindle by a screw 27 and disposed to be engaged by the operator in advancing the spindle and with it the tool from right to left of Fig. 1 and into operative relation to the grinding wheel to be ground thereby.

The two opposite end walls of the hollow shell 13 are provided with identical openings in longitudinal axial alignment forming two longitudinally spaced-apart finger bar bearings of which one is shown at 28 in Fig. 2. These bearing forming openings have their underside in the form of upwardly facing V-seats 29. A long rod-like finger bar 30 extends through the bearings 28, projects at opposite ends beyond the shell 13, and normally rests gravitationally on the seats 29. It is the usual practice to adjust the finger bar longitudinally to fit the different types and sizes of tools to be ground. The finger bar 30 is designed to be locked in its longitudinally adjusted position and for this purpose the portion of the front and top wall is thickened as shown in Fig. 2 to provide a gusset or boss 31 which tends to brace the front and top walls. The boss is provided with a vertically extending opening and is threaded to accommodate a set screw 32 in bearing engagement with the top of the finger bar. The outer end of the finger bar is provided with an adjustable finger rest 33 which in turn carries a finger 34 for engagement in the spiral H of the tool G, as is usual in such devices.

The rockable body 12 is designed to be rocked about a longitudinally extending axis at the far side of the base and for this purpose there is provided a hinged mounting 35. This mounting includes two longitudinally spaced-apart pairs of recesses 36, with one recess of each pair formed on the underside of the body 12 and facing downwardly and the other recess of the associated pair in the top side of the base 10 and facing upwardly. A pair of spherical balls 37, one for each pair of recesses and fitting therein, con-

stitute hinges of a ball bearing type on which the body may be turned.

At the opposite or front side of the body there is provided an inwardly extending flange forming a lift shoulder 38, and there is provided a coacting body rocking device 39 for engaging the flange to elevate the front side of the body. For this purpose the base is drilled transversely from its forward side to form a cylindrical form of lever bearing 40. A lever of L-shaped form provides at the front of the machine an upstanding handle 41 for rocking the lever and provides a cam rod 42 rotatable in the drilled bearing 40. The cam rod 42 at the part thereof just below the flange 38 is flattened on one side to provide a two-throw cam 43. A vertically extending lift pin 44 slidably guided in the base engages at its lower end and bears on the cam 43 and engages at its upper end the underside of the flange 38. A dowel pin 45 demountably fixed in the base engages in an annular recess 46 formed in the rod 42 to permit rotation but to defeat axial movement of the lever.

There is shown a resilient re-set device 47 for restoring the body 12 to its normal inoperative position when permitted to do so by the rotation of the cam 43 with its flat side uppermost as shown in Fig. 2. To accommodate the re-set device the portion of the top and rear wall at the center thereof is cast with a block-like thickened wall 48 forming a gusset as shown in section in Fig. 2 and in front elevation in ghost outline in Fig. 1. The thickened portion 48 is drilled through the top wall 14 to provide at the bottom of the wall gusset 48 an aperture 49 and thereabove with the upper portion of the drilling enlarged to provide a pocket 50. The bottom of the pocket forms an upwardly facing spring bearing shoulder 51. Extending through the pocket and aperture and in threaded engagement with the base is a headed screw 52. A spring 53 is located between the head of the screw and the shoulder 51 and is biased in a tendency to maintain the flange 38 of the body in bearing engagement with the lift pin 44 in all positions of the same.

In this way spring 53 is operative at all times to maintain shoulder 38 in bearing engagement with lift pin 44. With the lift pin engaging the flat lobe side of the cam and in which position the handle 41 is vertical, the body 12 is at the extreme left end of its arc of swing as viewed in Fig. 2, and in this position the tool is clear of the grinding surface F and can be withdrawn longitudinally without contacting the grinder. In this way the lever handle 41 when upstanding is an indication that the tool is free to be returned to its initial grinding position. On the other hand, when the lever is tilted one way or the other from its upstanding position it signals the fact that the tool has been swung into position so that when axially advanced it will be in proper relation to the grinding device to have its cutting edge ground thereby. Differently expressed, the throw of the cam when shifted to bring its round portion under the pin 44 will accurately locate the tool in proper position to be ground. By simply replacing the lever currently in use by another having a different cam throw the grinding position of the tool may be re-set as desired.

The spindle 22 is located to rest on a cradle formed by two pairs of upwardly extending cradle-forming pins of which two of the pins are shown at 54 and 55 in Fig. 3. Each set of cradle-forming pins is associated with a vertically extending hold-down pin 56, so that at each head there are three centering pins. The pins are mounted in their associated heads 18 and 19 to extend circularly spaced apart and are slidably mounted in radially extending bores or sockets 57 in which they are movable with a sliding fit, and the outer ends of which pins project beyond the heads so as to provide finger piece ends 58 for engagement by the finger of the operator when adjusting the pins as hereinafter described. More accurately defined, the two cradle-forming pins 54—55 each forms an angle of forty-five degrees with a vertical passing through the axis of the centered spindle 22, and pin 56 is spaced 135° from each of the pins 54 and 55.

The pins are each provided at their inner ends with hard bearing points 59 with their exposed portions of semispherical form and, in the instant case, formed of Carboloy. It is the intent here to mimimize as far as possible the areas of contact between these bearing pins and the outer surfaces of the spindle 22 slidable and rotatable thereon.

For the purpose of accommodating the structure to receive spindles of different external diameters it is suggested that each of the bearing pins be adjustable radially in their associated heads. For this purpose the lower or cradle-forming pins 54 and 55 of each set are provided on the sides thereof with a plurality of longitudinally spaced-apart conical screw-receiving recesses 61. Each head is provided in the plane of the bearing pins with a plurality of recesses 60, one for each bearing pin, each extending at right angles to the length of its associated pin and exposed at its outer end. A pair of cone-pointed screws 62 are screwed into the recesses associated with the cradle pins in position to have their pointed ends inserted selectively into one of the recesses 61. The recesses 61 are variably spaced apart longitudinally and are arranged so that when the four screws 62 engage in the proper recesses, as for instance in the innermost recesses as shown in Fig. 3, the four bearing points 59 will define the surface of a true cylinder, hereinafter sometimes referred to as a cylinder of reference, and thus the pins will act to fix the axis of the tool spindle 22 relative to the fixed grinding device.

In the case of each of the hold-down pins 56, a flat screw 63 is threaded into the associated recess 60 and is disposed to bear transversely on the hold-down pin 56 to lock it into whatever position it may happen to come by reason of the diameter of the spindle for the time being mounted in the attachment.

The bearing apertures 20 and 21 are of larger diameter than the external diameter of the tool spindle 22, and thus there is formed in each head 17 and 18 an annular air space 64 open at opposite ends to permit a free flow of cooling air to pass between the more or less warm spindle 22 and the air-cooled heads 17 and 18. Air passing the points 59 tends to clean the points.

In operation and assuming that the tool to be ground is driven into the bore of the spindle or into the bushing 23; that the finger bar 30 has been adjusted longitudinally in the body with the finger 34 adjusted to fit in the groove of the tool spiral H; that the bar 30 has been locked by set screw 32; and that the stop collar 24 has been adjusted on the spindle to limit the advance of the tool relative to the grinding wheel and with the grinding wheel rotating, the operator shifts the handle 41 of the lifting lever to bring the

curved or elevated portion of the cam 43 into bearing engagement with the lift pin 44 which, in turn, swings the body 12 as a whole slightly clockwise about the offset longitudinal axis provided by the hinge mounting 35 as indicated in Fig. 2, sufficiently to bring the cutting edge I of the tool into engagement with the grinding edge of the grinding wheel to sharpen the cutting edge, following conventional practices in this respect. More specifically described, the operator engages the knob 26 and shifts the spindle 22 axially and with it the tool G from right to left in the showing in Fig. 1, until the cutting edge has advanced into engagement with and beyond the grinding portion F of the grinding wheel. It will be understood that the engagement of the finger 34 in the groove H controls the rotation of the spindle as it is so advanced axially. At the termination of the grinding operation, the operator throws the lever back into the upright position shown in Figs. 1 and 2, and this permits the spring 53 to rock the body back counterclockwise into its normal position with the tool spaced to the left from the grinding wheel and in which position the spindle may be retracted from left to right of Fig. 1 and to its initial position without possiblity of the tool contacting the grinding wheel.

The instant device has many practical advantages over known devices. For instance, the locating of the hinge connection at the rear side and the lifting cam at the front side provides a long leverage effect considered transversely of the body so that a relatively short upward camming by the swinging of the lever handle 41 causes a material extent of lateral shifting of the spindle and its associated tool in moving from the inoperative into the operative position to cause the tool to be sharpened. The normal tendency of the tool when permitted to do so is to escape from the grinding device.

Assuming that the tool and spindle will become hot during the grinding operation, every effort is made to withdraw the heat as promptly as possible and dissipate it over extensive exposed cooling areas and in this way keep the parts, and particularly the tool, cool.

As the spindle is supported solely on the cradle provided by the inner ends of the pins 54 and 55, the heat transference between the spindle and the body is reduced in area to the four points forming the crowns of the semispherical hard bearings at 59, with perhaps some heat transference across the joints provided by the points 59 of the bearing down pins 56.

The ends of the annular spaces 64 are open to permit air to flow therethrough to thus cool both the interior of the heads 16—17, as well as the portion of the spindle within the outlines of the heads. As the spindle is rotating at least during the grinding step, the rotating spindle will tend to act as a blower to advance the air through the spaces 64 to perform its cooling and scavenging functions. The spindle itself is made hollow and of the least possible cross-section of material and, while one end must be closed by the tool, its other end is open through the opening in the knurled handle 26. Of course, some heat will pass by conduction, by radiation, or otherwise, into the heads 16 and 17. These heads are designed to provide the most extensively possible exposed surface to the cooling effect of the environmental air. They extend upwardly from the associated main body portion in widely spaced-apart relation and are made as thin as possible without sacrificing their necessary structural strength.

I claim:

1. In a device of the class described, the combination with a grinding device, of an attachment including a base, a body having one side thereof pivotally mounted on the base to turn about longitudinal axis, a tool spindle journaled in the upper portion of the body for free rotary and axial movement and provided with means for carrying a spiral tool to be ground, a finger bar adjustably mounted in the body at two widely spaced-apart points and extending parallel to the spindle and provided at one end with a guide finger for engaging in the spiral of the tool to be ground, said body provided on the side opposite the side pivoted to the base with a downwardly facing shoulder, a lift pin slidably mounted for vertical movement in the body and on which the shoulder rests, spring means reacting between the base and body tending to maintain the shoulder in bearing engagement on the lift pin, a lever with one end forming an exposed handle at the front of the attachment and the other end being rod-like and journaled in the body for rocking movement about a transverse axis, and said rod-like end in the part thereof underlapping the lift pin forming a two-throw cam and operative as the handle is rocked in one direction to act through the lift pin to cam the adjacent side of the body to shift the same upwardly about its axis and to shift the spindle and the tool carried thereby laterally over an arc whose center is at the longitudinal axis to bring the tool into operative engagement with the grinding device and when the handle is rocked in the opposite direction to shift the cam into position to permit the spring means to react between the base and body to shift the tool in reverse direction over said arc to remove it from the grinding device.

2. In a tool grinding machine, the combination of a grinding wheel, of an attachment including a base, a body pivotally mounted to the base for rocking movement about a longitudinal axis, spring means biased for maintaining the body in position fixed relative to the base and spaced from the grinding wheel, control means for engaging the body for shifting the body about said axis and against the resistance of said spring means, said body provided with a pair of upstanding spindle bearing standards longitudinally spaced apart and exposed for air-cooling, a long, longitudinally extending tool spindle journaled in both standards for free manually imposed rotary and axial movement, with substantially the entire exterior surface of the spindle exposed for air-cooling, journaling means carried by each standard engaging the spindle over highly restricted areas of contact, spacing the spindle from the standards and operative to minimize heat transference from the spindle to the standards, said spindle having a hollow bore extending therethrough open at one end to expose its inner surface for air-cooling and open at its opposite end to provide a mounting for receiving the tool to be ground.

3. In a tool grinding machine, the combination with a grinding device, of an attachment for the machine including a fixed base, a rockable body carried thereby, a pair of standards projecting from the base and rockable therewith, said standards being longitudinally spaced apart to expose the same for air-cooling, each of said standards provided with an opening extending

therethrough in coaxial alignment one with the other, a tubular spindle of cylindrical form extending through both openings and exposed for air-cooling between the standards and at opposite ends thereof, the end of the bore of the spindle adjacent the grinding device providing means for mounting the tool to be ground, the external diameter of the spindle being less than the internal diameter of the openings in the standards to provide annular air-cooling spaces between each of the standards and the portions of the spindle within their outlines, three centering pins carried by each of the standards, circularly spaced apart and extending radially of the spindle for centering the spindle in the standards, and means for mounting the body on the base for lateral rocking movement to shift the spindle and thus to bring the tool carried thereby laterally into and out of operative engagement with the grinding device.

4. In a machine for grinding spiral tools, the combination of a grinding device, of a tool-carrying and guiding device including a body having a pair of bearing standards projecting upwardly and integrally therefrom in longitudinally spaced-apart relation, said standards provided with coaxial cylindrical apertures, and each standard provided with a plurality of hard bearing points defining a bearing circle approximately centered in each aperture, a tool carrying spindle mounted in the circles for free rotary and axial movement, said spindle provided at the end adjacent the grinding device with means for mounting therein the tool to be ground, the lower part of the body being for the most part hollow and having a top, side and end walls connected to form the body as a one-piece integral rugged structure providing an extensive heat radiator for discharging therefrom heat received from the spindle through the standards, the two end walls of the lower part provided with openings in axial alignment, a finger bar extending through both of the end wall openings parallel to and offset from the spindle and projecting at opposite ends beyond the body and exposed for air cooling, a set screw carried by the body between its end walls and bearing on the finger bar to lock it in longitudinally adjusted position relative to the body and to force the finger bar laterally into bearing engagement with the end walls at the openings therein and said finger bar at the end adjacent the grinding device provided with an adjustable finger for engaging the spiral of the tool to be ground.

5. In a mechanism for holding and guiding the spiral cutting edge of a tool and which is adapted to be ground by passing the tool longitudinally along a grinder, in combination, a spindle for holding the tool, a rockable body, means for slidably and rotatively mounting the spindle in the body, a guide adapted to engage the spiral cutting edge of the tool, means for mounting the guide in the body, a supporting base, means offset to one side of the body for rockably mounting the body to the base for movement about an axis parallel to the axis of the spindle and below the body, resilient means reacting between the base and body and biased in a tendency to rotate the body about said axis in a direction to shift the spindle and therewith to remove the tool from the grinder so as to permit the spindle and tool to be shifted without being damaged by contacting the grinding surface of the grinder, and manually actuated camming means, reacting between the base and body and operating in one position

of the camming means to form a stop for limiting the movement of the body in its non-grinding position and in another position acting against the tension of resilient means to set the spindle and therethrough to set the tool in operative relation to the grinding surface to be ground thereby.

6. In a mechanism for holding and guiding the spiral cutting edge of a tool relative to a grinding device, the combination with a grinding device, of a spindle for receiving the tool, a body in which the spindle is mounted for free and thus unrestrained rotary and axial movement relative to the grinding device, a base for supporting the body, means hingedly connecting the body and base for relative rocking movement about a rocking axis parallel to the axis of the spindle, a spring reacting between the base and body independently of the spindle and tending normally to tilt the body and with it the spindle relative to the base in a direction to move the tool clear of the grinding device, and a manually actuated two-lobe cam in one position reacting between the base and body for rocking the body about the rocking axis against the resistance of the spring and into position to bring the tool in operative relation to the grinder to be ground thereby and in another position to permit the spring to shift the body into position to space the tool from the grinding device.

7. In a device for holding and guiding a tool having a spiral portion with a longitudinal cutting edge adapted to be ground by passing the same along a grinder, the combination of a spindle provided with means for holding the tool, a body in the upper portion of which the spindle is mounted for free rotary and axial movement, a base for supporting the body, the upper face of the base and the lower face of the body provided in offset relation to their vertical medial plane with at least one set of recesses facing each other, a ball forming a hinge element fitted in the recesses and forming a hinge mounting between the bottom of the body and the top of the base, a support carried by the base on the opposite side of the medial plane and on which the bottom of the body normally rests, spring means reacting between the body and base biased to maintain the body at all times on said support and manually controlled means for lifting the support to cause the body to rock in a transverse arc about the axis of turn provided by the ball and thus shift the spindle and with it the tool into position to be ground.

8. In a device of the class described, the combination of a base provided at one side thereof with an element of a hinge connection and at an opposite side with a vertically movable lift pin, a body normally resting on said hinge connection and on said pin, a tool spindle carried in the upper portion of the body and laterally shiftable therewith, a spring reacting between the body and base biased to maintain the body in resilient bearing engagement with its two supports provided by the lift pin and hinge connection and a cam shaft rotatably mounted in the base and provided with a two-position cam, in one position acting on the lift pin to elevate the same and cause the body to rock about the hinge connection against the tension of the spring.

9. In a device of the class described, the combination of a base, a body, a tool spindle journaled in the body for rotary and axial movement, means for mounting one side of the body to the base for rocking movement about an axis parallel to the

axis of the spindle, the side of the base opposite said mounting provided with a shoulder, a manually actuated cam journaled in the base for rotary movement about an axis at right angles to the rocking axis and thus also to the axis of the spindle, a lift pin slidably mounted in the base for a limited vertical movement, the lower end of the pin resting on the cam and elevated thereby and the upper end of the pin bearing on the shoulder, and spring means reacting between the base and body and biased to maintain the spindle in a prefixed position relative to the base and to cause the shoulder to bear resiliently on the pin and therethrough to maintain the lift pin in engagement with the cam.

10. In a device for holding and guiding a tool having a longitudinal spiral portion with a longitudinal cutting edge which is adapted to be ground by passing the same longitudinally and rotatively along a grinder, in combination, a tubular spindle adapted to receive in its bore selectively either the tool to be ground or a bushing for the tool, a body having a main lower hollow portion and a pair of solid spaced-apart standards upstanding from the main portion and provided with openings in which the spindle is mounted for free rotary and axial movement to and from the position where the tool engages the grinder which grinds it, the openings of said standards being substantially in axial alignment, each standard provided on its underside with a pair of upwardly and radially extending sockets, each extending at an angle of about forty-five degrees from a vertical plane passing through the axis of the spindle, four bearing pins, two for each standard, one snugly fitted with a sliding fit in each socket and protruding into the bore in the associated standard and said pins coacting in pairs to provide a four-point cradle and said four pins at their inner ends provided with hard bearing points defining a cylinder of reference whose center is the center of the bore of the spindle, a pair of hold-down pins, one intruding into the top of each standard and adapted to engage the top side of the spindle to maintain the same on its cradle, and means for locking each of the pins in pre-set position.

11. In a device for guiding an end mill relative to a grinding device to sharpen the mill, comprising a body portion, a pair of upright standards integral with the body portion, and the upper portions of the standards forming relatively thin heads disposed in parallel relation and spaced part a material distance and with their openings substantially in axial alignment, a mill-carrying spindle extending through the two openings, the spindle having an external diameter less than the diameter of the openings thereby to provide annular clearances between the heads and the portion of the spindle within the outlines of the heads, each standard provided with three radially disposed spindle centering pins and with the pins of each head circularly spaced apart and each pin projecting into its associated annular clearance and provided at its inner end with a hard point of semispherical form each providing a point contact with the spindle of limited area and operating to mount the spindle with not more than six limited-area points of engagement located in spaced relation to the standards.

12. In a device for guiding a spirally fluted end mill relative to a grinding device to sharpen the longitudinal cutting edge of the mill, the combination of a base, a one-piece casting mounted on the base for rocking movement about an offset longitudinal axis, said casting including an open bottom hollow shell provided at opposite ends thereof with a pair of rugged upstanding and longitudinally spaced-apart standards, said shell including a top and outlining side walls integrally connected, the two end walls of the shell provided with openings forming a pair of longitudinally spaced-apart aligned bearings the lower parts of which form V-seats, a rod-like finger bar slidably mounted in said bearings, located on said V-seats with its ends projecting beyond the shell and provided at the end adjacent the mill with a finger for engaging in the flutes of the end mill to rotate the same as it is shifted axially into engagement with the grinding device, screw clamping means housed within the shell and engaging the finger bar intermediate its bearings in the end walls for locking the bar to the shell, a tool spindle journaled in the standards for rotary and axial movement and provided with means for mounting therein the mill to be ground and for centering the mill therein in position spaced from the tool spindle, and resilient means housed within the hollow shell and normally reacting between the casting and the base biased to return the casting into a position to remove the finger bar and with it the mill transversely from its operative engagement with the grinding device.

13. In a device of the class described, the combination with a grinding device, an attachment to the grinding device for guiding a spirally fluted end mill relative to the grinding device to cause it to grind the longitudinal cutting edges of the mill, of a base, a one-piece casting rockably mounted in the base to turn about a longitudinal axis at the rear side of and spaced outwardly beyond the side of the mill nearest the grinding device, the lower portion of said casting constituting an open bottom hollow shell and the upper portion constituting a pair of integral longitudinally spaced-apart upstanding standards whose upper ends form transversely extending flat annular heads, each head provided with an opening in longitudinal alignment with its companion, a tool spindle of tubular form passed through said openings and provided at one end with means for mounting the mill therein and provided at its other end with a handle for manually advancing the spindle and its mill, a longitudinally extending finger bar engaging the lower hollow portion of the shell at two widely spaced-apart points and having a length greater than that of the spindle, a lock-screw carried by the upper exposed portion of the shell and bearing on the finger rod to lock the same adjustably in position to cause its finger to engage in the flutes of the mill for the time being in the spindle, and resilient means housed within the shell reacting between the casting and base biased to move the casting about said axis and in a direction to space the mill away from the grinding device and camming means accessible from the front side of the shell and reacting between the casting and base to move the mill against the resistance of said resilient means into position to be acted upon by the grinding device.

14. In a device of the class described, the combination with a grinding device, an attachment to the grinding device for guiding a spirally fluted end mill relative to the grinding device to cause it to grind the longitudinal cutting edge of the mill of a base, a one-piece casting rockably mounted on the base to turn about a longitudinal axis, said casting including a pair of longitudinal-

ly spaced-apart upstanding standards each provided with an apertured head, a tool carrying tube constituting a tool spindle extending through the apertures of both heads and projecting beyond and extending between the heads and thus exposed for air cooling, said tube provided with means at the end nearest the grinding device for mounting the mill thereon and having its opposite end open for interior air cooling, a knob at said opposite end for manually shifting the tube, and each head provided with three circumferentially spaced-apart and radially disposed centering pins with their inner ends projecting into their associated apertures, each pin provided at its inner end with a semi-spherical hard metal bearing the bearings coacting to define a cylinder of reference of less diameter than said apertures and acting to space the tube from the heads and thus to provide an annular air space between each head and the portion of the tube within the outline of each head.

15. In a device for holding and guiding a tool having a longitudinal spiral portion with a longitudinal cutting edge which is adapted to be ground by passing the same longitudinally and rotatively along a grinder by finger manipulation, the combination of a pair of spaced-apart standards each provided with an opening extending therethrough and in axial alignment, a tool-supporting spindle in the form of a tube, extending across the space between the standards and having its ends each projecting beyond its adjacent standard, said spindle-forming tube having a bore extending therethrough wide open end to end and having an internal diameter forming a large proportion of the external diameter and thus forming a substantially uniform and thin cross section of material, one end of the bore providing means for mounting therein the tool to be ground, a knurled knob pinned to the other end and located externally of the bore for finger manipulating the spindles, a stop collar slidably adjustable on the spindle between the knob and the adjacent standard, said spindle having an external diameter materially less than the diameter of the opening in the standards and centering pins carried by each standard adjustable thereto radially thereof and engaging the spindle to locate the same at least approximately centered in the openings and in spaced relation to both standards to provide annular air-spaces between the spindle and the standards.

16. In a device for holding and guiding a tool which is adapted to be ground by passing the tool longitudinally and rotatively by manual action across a grinding wheel, a spindle for carrying the tool, rockable means for supporting the tool for free operative motion and for locating it selectively either in operative engagement with the grinding wheel or in an inoperative position spacing the tool from the grinding wheel, resilient means biased to maintain the tool normally in its inoperative position free of the grinding wheel said rockable means including two longitudinally spaced apart standards having aligned apertures through which the spindle extends, and with the portion of the spindle between the standards exposed for air cooling, each standard provided with cradle forming means including axially shiftable pins mounted for radial movement in each standard and whose inner ends are provided with round faced bearing points of Carboloy coacting to define a cylinder of reference having exactly the external diameter of the spindle and providing a plurality of point contacts with the spindle.

17. In a mechanism for holding and guiding the spiral cutting edge of a tool and which is adapted to be ground by passing the tool longitudinally along a grinder, in combination, a grinder mounted for rotary movement about its axis a spindle for holding the tool, a rockable body, means for slidably and rotatively mounting the spindle in the body with its axis at right angles to the grinder axis, a guide mounted in the body and adapted to engage the spiral cutting edge of the tool, a supporting base, means for rockably mounting the body to the base for movement about an axis parallel to the axis of the spindle, resilient means at all times reacting between the base and body and biased in a tendency to rotate the body about said axis in a direction to shift the spindle and therewith to remove the tool from the grinder so as to permit the spindle and tool to be shifted without being damaged by contacting the grinding surface of the grinder, a stop on the base for limiting the movement of the body under load from said resilient means and manually actuated means operatively connected to the body to rock the same away from said stop against the resistance of said resilient means to move the spindle and with it to move the tool at will into a manually controlled operative engagement with the grinder.

18. In a device of the class described, the combination with an upstanding standard provided on one side with an extension, said standard provided with a bearing aperture of cylindrical form extending therethrough at the extension and forming the extension into an annular ring-like head, said head provided with three circularly spaced-apart and radially extending sockets extending therethrough, the two lowermost sockets each forming an angle of about forty-five degrees with a vertical passing through the axis of the aperture, a pair of cradle-forming pins slidably mounted in said two lowermost sockets and having their inner ends protruding into the aperture and each of said pins provided on a side thereof and within the outline of the head with a recess and at its inner end with a spindle-engaging bearing, the head provided with a pair of cone-pointed screws, one for each of the associated recesses, and with the parts arranged so that when said screws are engaged in the recesses the bearings at the inner ends of the pins are equidistantly spaced from the axis of the aperture, a spindle of cylindrical form mounted for free rotary movement on said bearings, and a hold-down pin carried by the head, disposed in said vertical line and acting on top of the spindle to maintain the same seated on said cradle-forming pins.

19. In a device for holding and guiding a tool which is adapted to be ground by passing the tool longitudinally and rotatively across a grinding wheel and wherein the tool is apt to become hot as an incident of the grinding operation, the combination of a spindle for holding the tool and for receiving and radiating heat received from the tool carried thereby, a one-piece metallic casting providing a support and heat radiator for the spindle, said casting including a body for the most part hollow to minimize its volumetric capacity to store heat and providing extensive heat radiating surfaces exposed to the cooling effect of the ambient air and said casting including a pair of standards integral with and upstanding from the body, each standard provided with an aperture extending therethrough and in which apertures the spindle is substantially centered, at least one of the apertures having a diameter materially

greater than the diameter of the spindle therein and forming an annular air space between the spindle and the wall of said aperture, open at its ends to opposite sides of the associated standard, and adjustable mounting means including a plurality of pins carried by said associated standard extending across said annular air space and provided at their inner ends with bearing points for engaging the spindle, said bearing points being exposed to the cooling effects of air passing through the air space.

20. In a device of the class described, the combination of a grinding wheel having a grinding face defining a plane of reference, a spindle for holding a tool to be ground when passed across said grinding face, a body extending on opposite sides of said plane of reference and in which body the spindle is mounted for free axial and rotative movement, a base for supporting the body, a hinge mounting between the body and base whose hinge axis is parallel to and is on the side of the plane of reference opposite to that containing the axis of the spindle, stop means on the base for limiting the movement of the body and with it the spindle about the hinge axis in the direction to move the tool carried by the spindle away from the grinding wheel, a spring reacting between the hinge mounting and the stop means biased at all times to move the body into engagement with the stop means, and manually controlled means for rocking the body about the hinge axis and against the resistance of the spring to bring the tool carried by the spindle into a manually controlled pressing engagement with the grinding wheel to be ground thereby.

CARL J. HERTLEIN.

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