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DRILL GRINDING APPARATUS

Filed Feb. 13, 1957

4 Sheets-Sheet 1

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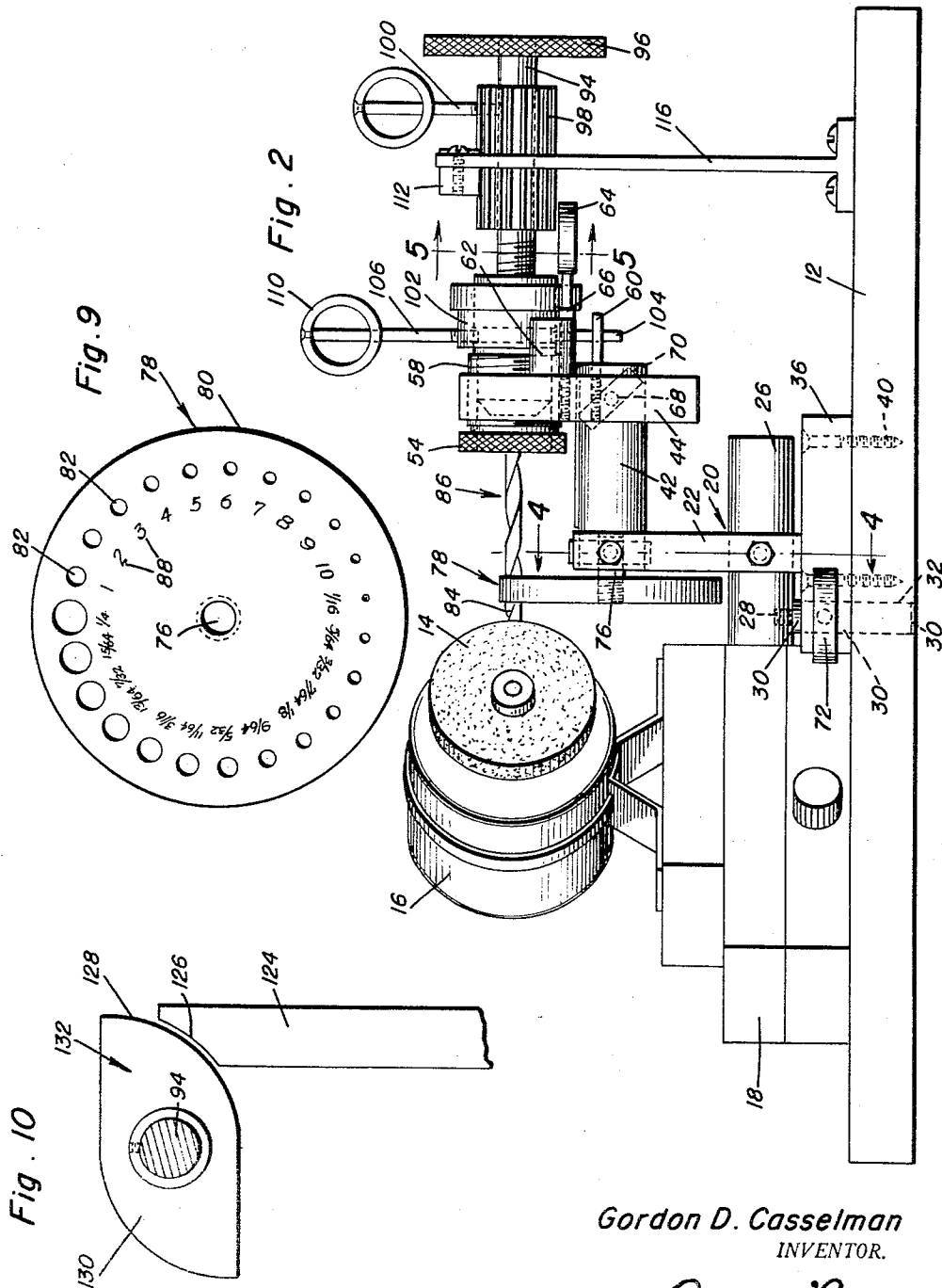
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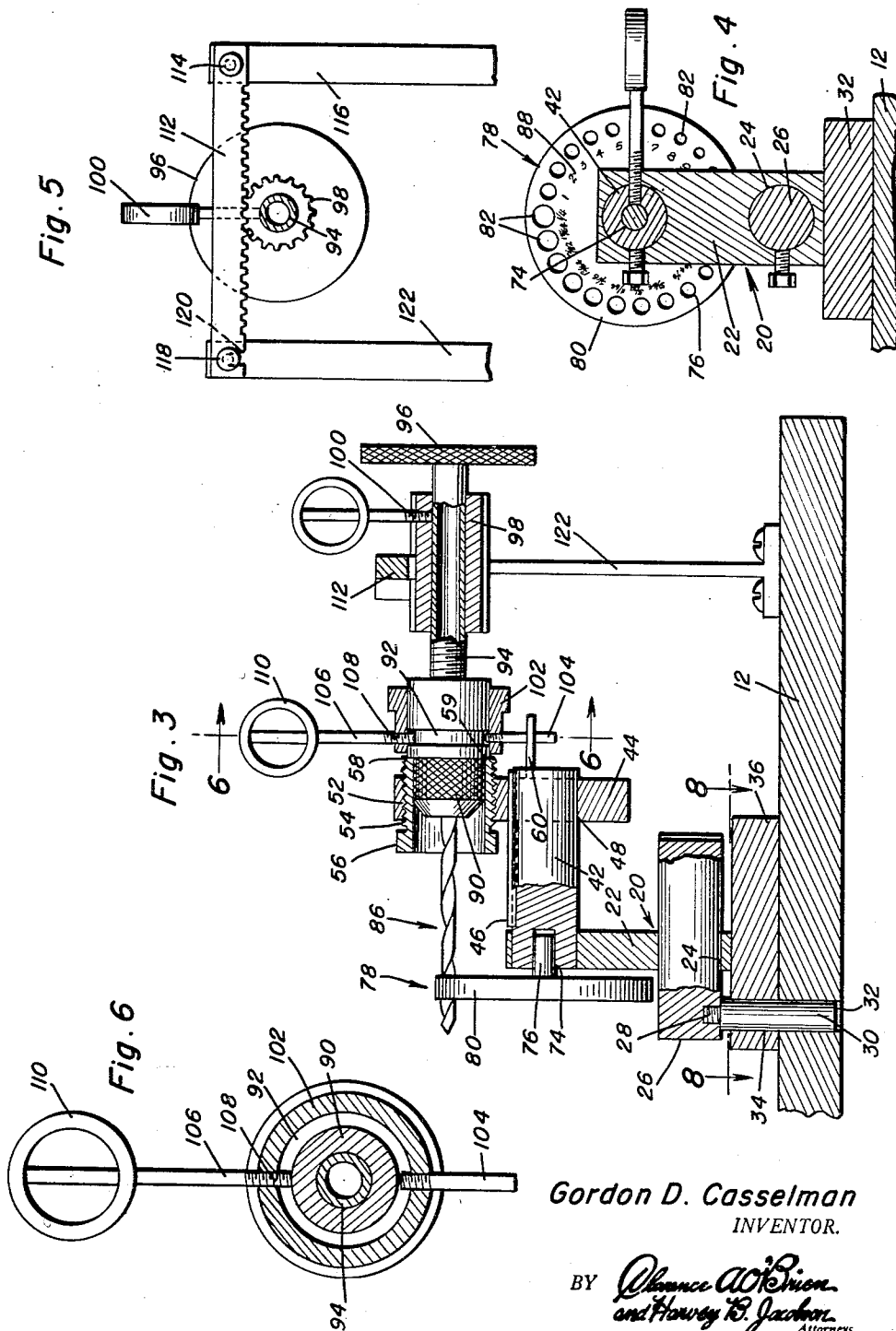
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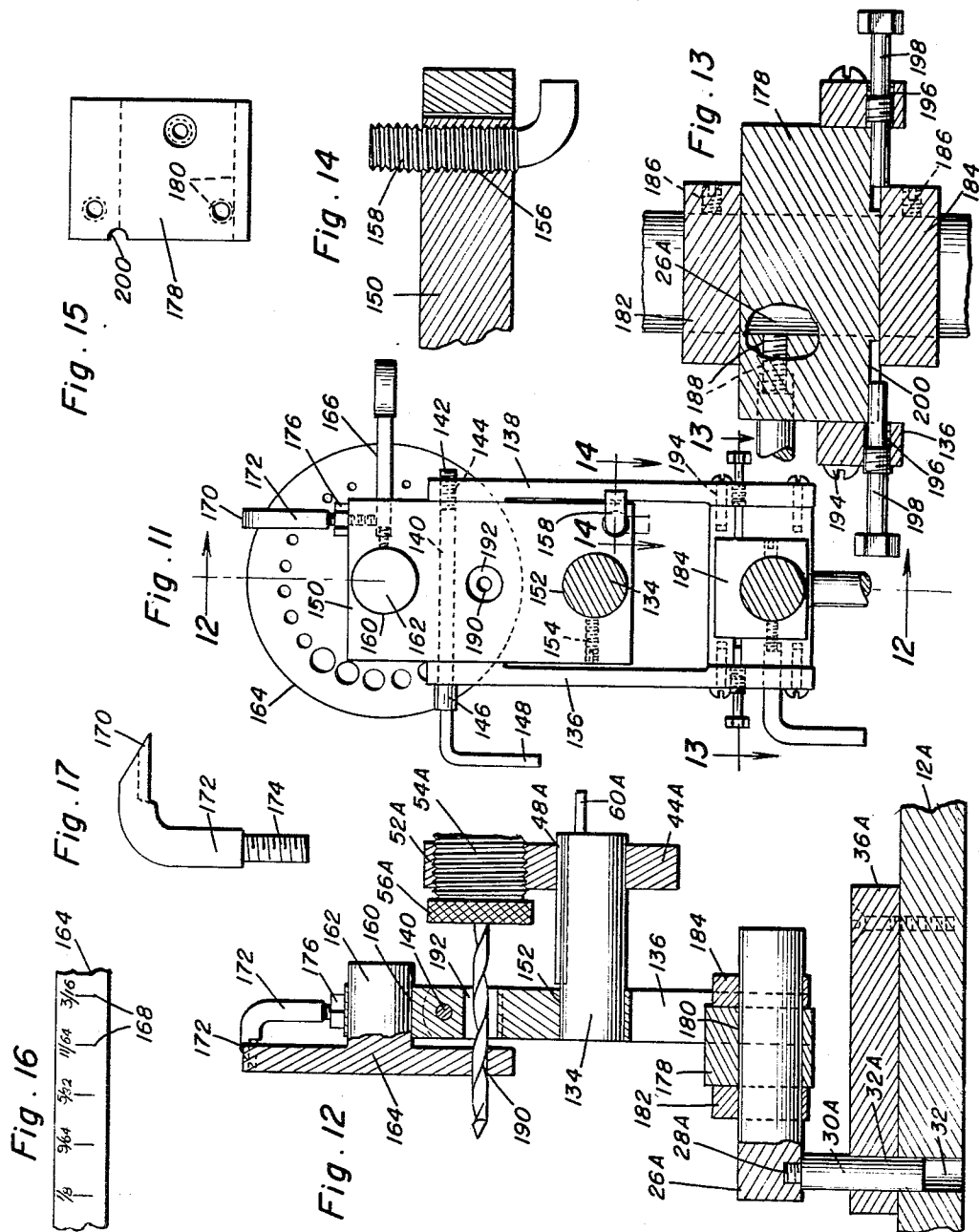
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4 Sheets-Sheet 4



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DRILL GRINDING APPARATUS

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12 Claims. (Cl. 51—100)

The present invention relates to drill grinding, generally speaking, and has reference, more particularly, to a structurally novel and distinct apparatus which is characterized by a construction the use of which will obtain satisfactory results for twist drills which have been ground by the means provided.

It is the generally well accepted belief that in a properly ground twist drill the two cutting edges should have the same inclination and come in contact with the work throughout the entire length at the same time, and the clearance surface back of the cutting edge should vary from the point of the drill, where it is greatest, to the periphery, where it is the least acute. When the leading end of the drill is effectually held, guided and handled in part manually the end will be given a conical surface, the apex of the cone being above the point of the drill, and thus insuring proper grinding of the "lips" of the drill until sharp cutting edges are obtained. Obtaining the results in keeping with the above expectations has posed a problem. A careful analysis of the problem has resulted in the bringing into being of the apparatus which, as herein revealed, makes it possible to achieve drill grinding results which are highly satisfactory indeed.

Grinding and sharpening small twist drills not only necessitates practical and reliable structural means for holding, guiding and advancing the end of the drill toward the peripheral edge of the grinding stone or wheel, one has also to consider the fact that inherent flexible properties in a given small drill permits the cutting end to whip in varying directions and consequently interferes with focusing the end of the drill and keeping it in effectual grinding contact with the grinding wheel. It follows that an object of the instant invention is to provide a novel drill rest. This is interposed between the oblique angled grinding wheel or stone and the chuck in which the drill is held and progressively advanced. Therefore, the portion of the drill cooperating therewith is given added support and is stabilized and highly efficient and satisfactory grinding results are achieved.

The invention also has to do with novel, practical and simplified mechanical means which, briefly interpreted, is characterized by a stationary foundation, a table or an equivalent base for example, having vertical bearing means, a motor driven grinding wheel mounted on said foundation adjacent to said bearing means; a stand co-operable with said grinding wheel and embodying a vertical spindle at its bottom journaled for rotation in said bearing, a first horizontal arm mounted atop said spindle, a standard adjustably mounted on and rising vertically from said first axle, and a second horizontal arm mounted atop said standard; a chuck-assembly embodying a chuck in which the stem-end of a twist drill is intended to be clamped, a shaft connected to and axially aligned with said chuck and having a hand-wheel at its actuatable end for oscillating and sliding the chuck; and holder and guide means for said chuck-assembly adjustably mounted on said second arm.

Somewhat more specifically the invention introduces the

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utilization in the construction stated of a bushing. This is adjustably mounted and supported in axial alignment with said chuck. The end of the bushing which is nearest to the chuck constitutes a shoulder which is referred to herein as a gauge-like stop and the chuck assembly has a collar thereon, the collar functioning as a limiting stop which is a sort of a final position stop for the chuck-assembly when the chuck therein embodies and abuts said first-named stop.

The invention also features the construction stated and wherein the part thereof which is hereinafter referred to as holder and guide means, is provided with outstanding members which are defined as turn-pin rests. As will be later seen the aforementioned collar has pins at exactly diametrically opposite points and these extend out and they operate in the path in which the turn-pin rests are located. This means that as the holder and guide means is oscillated or turned from left to right and vice versa, the turn limiting stop pins thereon engage the turn-pin rests and thus assist the user in manipulating the chuck-assembly in such a way that accurate grinding results are assured.

A general objective of the invention is to structurally, functionally and otherwise improve upon similarly constructed and performing grinding machines, devices and the like and, in so doing, to provide a construction in which manufacturers, users and others will find their respective requirements and needs not only taken into account but satisfactorily met.

Then too, it is a somewhat general objective to improve upon and reduce the number of parts entering into the over-all structural combination, thereby not only increasing the efficiency of the structure as an entity, but rendering the same less costly to manufacture and to otherwise simplify factors of assembling, sale, repairing and so on.

Other objects, features and advantages will become more readily apparent from the following description and the accompanying sheets of illustrative, but not restrictive, drawings.

In the drawings, wherein like numerals are employed to designate like parts throughout the views:

Figure 1 is a top plan view of a drill holding, guiding and grinding apparatus constructed in accordance with the principles of the present invention and showing the manner in which the same is set-up and used;

Figure 2 is a side elevational view of the same;

Figure 3 is a fragmentary view, with portions appearing in elevation, taken approximately on the plane of the line 3—3 of Figure 1, looking in the direction of the arrows;

Figure 4 is a section on the vertical line 4—4 of Figure 2 looking in the direction of the arrows;

Figure 5 is a section on the line 5—5 of Figure 2;

Figure 6 is a section on the line 6—6 of Figure 3;

Figure 7 is a view in full lines and dotted lines and detailing a part hereinafter referred to as a bracket;

Figure 8 is a view on the horizontal line 8—8 of Figure 3;

Figure 9 is a view on an enlarged scale of one of the outstanding improvements; namely, the anti-whip selectively usable disk or equivalent stabilizing device;

Figure 10 is a view of a modified aspect of the concept;

Figure 11 is a further modification wherein the assembly constituting the aforementioned dial and bracket supporting "stand" differs from that seen in Figures 3 and 4;

Figure 12 is a fragmentary view with parts in section and elevation on the line 12—12 of Figure 11;

Figures 13 and 14 are exaggerated fragmentary sectional views of details taken on the lines 13—13 and 14—14 of Figure 11;

Figure 15 is an end elevation of a block member to be hereinafter described;

Figure 16 is an enlarged fragmentary view of an edge portion of the dial; and

Figure 17 is an enlarged detail view of an indicating finger which cooperates in the manner shown in Figures 11 and 12.

Reference is to be had first to Figures 1 to 10, inclusive.

Referring now to the drawings the aforementioned foundation may be a table, workbench or any equivalent structural part. More specifically this is referred to here as a suitable base 12. The grinding wheel (usually an emery wheel) is supported in an elevated position at the intended oblique angle. This is denoted by the numeral 14 and is operated by an electric motor 16 supported on blocks or equivalent base means 18.

Although comprising several cooperating components or parts the means now to be introduced is to be construed as an entity. It is described generally as a "stand" and is denoted by the numeral 20. As perhaps best shown in Figures 2 and 3 it comprises a standard or upright means 22 of block-like form having its lower apertured portion 24 adjustably mounted on a horizontally disposed first arm or an equivalent support member 26. The latter is suitably fastened as at 28 (Figure 3) to the upper end of a depending stud which is here designated as a spindle 30. The spindle is turnable in a bearing hole or socket 32 provided therefor in the base 12. The spindle also extends through a bore 34 in a bed plate 36 which is interposed between the lower end of the standard or upright 22 and the top of the base 12. In practice, and as shown in Figure 8, this bed plate is provided with linearly straight radial marker lines 38 with degree graduations associated therewith. The plate 36 is screwed or otherwise fixed at 40 to the base. The upper apertured end of the standard 22 has a second horizontal arm or an equivalent rod member 42 mounted thereon and extending laterally therefrom and in spaced parallelism above the first arm 26. This arm 42 serves to accommodate what is broadly referred to as mounting and guiding means. Preferably, this means takes the form of a simple block-like bracket 44 the lower or median portion of which is slidably keyed at 46 on the arm. More specifically, the arm 42 extends through the opening 48 in the bracket as shown properly in Figures 2 and 3. A larger view of this bracket 44 is seen in Figure 7 wherein it will be seen that it has another opening 52 in its upper half portion and this, as perhaps best shown in Figure 3, is screw-threaded to accommodate the cooperating threads on the manually regulable bushing or sleeve 54. It will be noticed that said bushing is of a length that it extends through and beyond the respective ends of the threaded opening 52 and one portion is provided with a knurled finger-grip or flange 56. The other end portion provides what is hereinafter referred to as a stop or a stop shoulder 58. The block 44 is also provided with an outstanding pin 60 which constitutes a rest or check. Actually this pin 60 is another so-called "stop" but for convenience of description and differentiation it is being differentiated here as a turn-pin rest. Opposite the pin 60 there is a cam 62 and here again the latter is a complementary turn-pin rest. The cam has an opening therethrough and the shank of a setscrew 64 passes through the opening and is screwed into the screw-threaded hole in the block, the same being provided with a shoulder 66 which makes it possible to adjust and then bind the cam in an obvious manner. The cam can be turned around its point of mounting to cause the "rest" position thereof to be lowered or raised in a manner which will be hereinafter clarified.

Attention is now called to a setscrew 68 extending through one marginal edge of the block 44 at the right in Figure 7 and provided with a suitable ring-like finger-grip 70. In fact many of the setscrews disclosed herein are formed with this type of finger-grip and the grip and

screw together may be treated simply as a setscrew. In any event, this setscrew 68 engages with the axle or rod 42 whereby one may conveniently adjust and fasten the block or bracket 44 closer to or farther from the grinding stone or wheel 14. It may also be advisable here to mention that a similar setscrew 72 (Figs. 1 and 2) cooperates with the plate 36 and engages the spindle 30, making it possible to jack up or raise the entire stand 20 (parts 30, 26, 22 and 42) to thus position the bracket 44 and axis of the opening 52 therein above or below the horizontal center of the grinding wheel 14.

It will be further noticed that the upper arm 42 has an axial socket 74 in the left hand end to accommodate an axially fixed stud 76 on the rearward or proximal side of the aforementioned stabilizing means. This means is referred to generally by the numeral 78 and is also sometimes referred to as a disk or a "dial" 80. As is perhaps best evident from Figure 9 the dial is provided with equidistant circumferentially spaced pre-gauged drill receiving and stabilizing holes 82 to accommodate the cooperating end portion 84 of a twist drill 86 (Figures 2 and 3). It will be noticed that this proximal side has numerals 88 properly spaced and related to the holes 82 to designate the caliber or diameter thereof. The holes are progressively enlarged and the numerals are graduated accordingly. Consequently, the user selects the requisite size hole 82 in the stabilizing dial or disk and lines it up with the drill and passes the drill therethrough into cooperating engagement or contact with the grinding wheel in the manner illustrated in the drawings.

Another important phase of the construction is now to be considered and this is treated in a general way as a chuck-assembly. The chuck itself is best denoted (Figure 3) by the numeral 90 and is provided midway between its ends with an endless groove 92. The adjusting screw for the grips (not shown) within the chuck is here denoted by the numeral 94 and this is also described as a shaft and is provided on its proximal end, the end adjacent to the user, with a knurled hand wheel or an equivalent operating member 96. There is also a pinion 98 on the shaft and this is held in place by a setscrew 100. Furthermore, a flanged collar 102 is provided and this encircles the body of the chuck. On one side the collar 102 has an outstanding turn-stop-pin 104 and on the other diametrically opposite side there is a setscrew 106 which functions as a second turn-stop-pin and this is threaded at 108 and extends into the groove or channel 92, being provided on its outer end with a suitable finger-grip 110 which when it is tightened, locks the collar to the chuck. Thus, the collar 102 is rotatably but lockably keyed on the chuck. The collar does not contact bushing 58 but a shoulder 59 on the chuck 90 serves this function.

The numeral 112 in Figure 5 designates a rack bar one of which is pivotally mounted at 114 on a fixed standard or upright 116 carried by the aforementioned base 12. The opposite end of the rack bar is fastened by way of a headed pin 118 and notched 120 to the upper end of a cooperating standard 122. The rack bar bridges over the pinion and therefore a rack and pinion means is provided.

A substitute arrangement for the rack and pinion means just described is that shown in Figure 10 which comprises a single fixedly mounted upright 124 having its upper notched edge 126 serving as a cam surface for cooperation with a complementary cam surface 128, or an alternate cam surface 130 on the cam-like block 132, this being keyed or otherwise fastened on the aforementioned shaft 94 when this adaptation is to be used instead of the rack and pinion arrangement.

In operation the drill 86 which is to be sharpened is placed in the chuck 90 (Figures 1 and 2) in any position. The selectively usable dial-type stabilizer and rest for the end portion of the drill denoted at 73 is revolved so that the selected hole 82 (which would be the same size as the drill) is turned in correct position and locked

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in position by means of the thumb bolt. The user may next flip or move the rack 112 out of position and place the chuck-assembly in the screw-threaded bushing 54. By adjusting the bracket 44 on the axle 42 for the length of drill the position may be retained by tightening the setscrew 45. With the parts properly adjusted and the tip of the drill in grinding relationship to the abrasive wheel the user catches hold of the hand wheel 96 and turns the chuck-assembly from left to right. The aforementioned turn-stop pins or members 104 and 106 cooperate with the check stops 60 and 62 making it possible to satisfactorily turn the chuck-assembly the necessary amount in either direction.

The chuck-assembly 90 can be slipped out of the bushing 52 and turned over one-half revolution then replaced and the other half portion of the drill point can be sharpened. The general procedural step which are followed in handling twist drills and machines will enable the trained or skillful user to readily comprehend the manner of assembling and using the parts so that he may fully appreciate the resultful advantages gained and particularly the aid accorded by the presence of the so-called stabilizing dial 78. With this machine one can grind both lips of the drill exactly alike in regard to lip angle, lip length and clearance. It is to be noted that clearance is caused by the curve of the emery wheel and can be varied by the height at which the drill point contacts the emery wheel above the center of the emery wheel, or increasing the angle of the cutting edge with the horizontal on the emery wheel. This type of point makes an excellent edge for a boring tool in a lathe and has been used satisfactorily by your applicant.

By properly using the rack and pinion one can pivot the device so that the standard recommended clearance of 12° is obtainable.

By slight change of position of the dial 70 and bracket 44 and by raising the assembly by means of the aforementioned spindle 30 and the bearing 32 where the drill contacts the emery wheel much higher than otherwise it may be swung to a position 90° to the emery wheel and locked in position by means of the available thumb bolt. With this arrangement web thinning can be done accurately. The cutting edge of the lip can be ground off for brass and soft metals.

With the cam 132 on the shaft 94 (Figure 10) cooperating in a manner that the surfaces 126 and 128 bring about the desired camming action the same result can be obtained as with the somewhat more complicated rack and pinion means already touched upon.

In actual practice the emery wheel is set at approximately a 31° angle with respect to the rest of the structure so that the drill in contacting the same will be ground on a 59° angle. Lip angles of 49° or 69° or any other angle can be obtained by swinging the assembly on the aforementioned hinging or pivoting spindle 30. Not only this but flat lip angle grinding for reaming the bottom of a hole is capable of being readily accomplished with this construction.

Instead of using the "stand" so far described it is within the purview of the invention to utilize the alternate stand construction disclosed in Figures 11, 12 and 13. In so doing, the user does not change or eliminate any of the parts, motion or description of the concept covered but gives an added motion, that is, a rocking motion. This motion sharpens the drill more closely, resembling the expert hand sharpened drill and has greater appeal to men who know and use drills. With the construction featured in Figures 11, 12 and 13 one is able to eliminate the necessity of raising the entire assembly for web-thinning and cutting edge grinding. Actually, and as will be clear, this result is accomplished by tilting the device upward and locking it in a position to get the drill at any desired angle relative to the verticality or plane of the stone. The base in Figure 12 is denoted at

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12A, the bed plate 36A, the spindle 30A and sockets for the spindle at 32A. The spindle serves to adjustably mount the over-all stand and the upper screw-threaded end 28A is screwed into a socket provided therefor in the cooperating end portion of the first arm 26A. Corresponding parts for these will be found in the base and stand means already revealed. The second horizontal arm is denoted by the numeral 134 which carries an adjustably mounted bracket 44A having the aforementioned turn-pin-stop 60A. There is an opening 48A in the bracket slidable on the arm and keyed in place and there is a screw-threaded hole 52A at the top to accommodate the threaded bushing 54A having a finger-grip 56A. The upright means for mounting the arm 134 is best shown in Figure 11 wherein it will be seen that it is in the nature of a frame having spaced parallel uprights or frame members 136 and 138. Extending through openings in the upper portions thereof is a shaft 140 having a screw-threaded end portion 142 turnable in a screw-threaded hole 144 provided therefor in the upright 138. There is a shoulder 146 on the other end portion and outwardly of this there is a handcrank 148. This shaft serves to cradle an axle supporting plate 150 therein. The plate has an opening 152 in its lower end into which the aforementioned upper arm 134 is extended and held by setscrew 154. There is a screwthreaded hole 156 (Figure 14) receiving the screw-threaded end portion 158 of an L-shaped stop 158 which limits the tilting of the plate in one direction. When it is desired to fasten the plate against movement the threaded means 142, 144 is tightened up and the plate is bound frictionally between the uprights 136 and 138 in an obvious manner. There is a suitable hole 160 in the upper part of the plate into which the axial stud 162 fits. This stud is on the rearward side of the stabilizing dial or disk 164 as shown in Figure 12. The dial is held in any adjusted position by way of the setscrew 166. The dial has marginal markings or suitably numbered graduations 168 as shown in Figure 16. The cooperating horizontal end portion 170 of an indicator finger 172 cooperates therewith, said finger having a screw-threaded shank 174 fitting in a fixed nut provided therefor at 176.

The lower ends of the arms of the upright means attach to the first named p-arm 26A in the manner shown. That is to say, a block 178 is provided with a hole 180 which fits over the p-arm and is located between adjustable collars or shoulders 182 and 184 on the axle and held in place by the setscrews 186 as seen in Figure 13. The block 178 is held in its adjusted or intended position by way of a setscrew 188 in an obvious manner.

The new position of the dial 164 is such that the hole that holds the drill is now at the bottom of the dial instead of at the top, the hole being denoted at 190. The hole 192 is to let the drill reach the hole in the dial and the stop 158 blocks the amount of rock and can be adjusted for length or disengaged by turning down when web thinning is being done. The aforementioned indicator obviously points to the size of the hole desired, and the nut 176 is the lock nut. The aforementioned block 178 is fastened between the uprights at 194 (Figure 11). The uprights are provided adjacent their lower ends with screw-threaded holes 196 for the accessible bolts 198, the shank portions of the bolts extending grooves 200 provided therefor in the face of the block 178. These elements 198 constitute projectable and retractable manually adjustable regulating pins. With reference to Figure 11 it will be seen that by screwing both pins in tight against the marginal edges of the collar 184 the entire frame will be locked to the collars and the collars in turn locked to the arm 26A. By loosening either one or the other of these two pins 198, one can check the swinging from left to right of the frame. Thus, the frame, as an assembly, can be adjusted, that is rocked from left to right. Also the plate 150 can be cradled in the frame. The improved parts are thus designed to

rotate counter-clockwise and clockwise around the rod 26A to adjust the cutting edge of drill to the right edge of emery wheel. This motion is limited and controlled by positions of the stop pins 198 properly regulated relative to each other.

It has always been regarded as a problem to get the cutting lip of a drill in the correct position to properly sharpen the drill. The collar 102 revealed enables the operator to adjust and readjust satisfactorily and to lock the drill in correct position and also serves to automatically insure the other lip being ground exactly equal by reason of the fact that it is not necessary to change the position of the drill in the chuck.

It is believed that by taking the specification in conjunction with the drawings and considering too the claims a clear and comprehensive understanding of the construction, operation and features and advantages will be obtained. In these circumstances a more extensive description is thought to be unnecessary.

Changes in shape, size, rearrangement of parts and variations in the materials may be resorted to in actual practice without departing from the spirit of the invention or the scope of the invention as claimed.

What is claimed as new is as follows:

1. For use in grinding and sharpening twist drills, an apparatus comprising a horizontal stationary foundation, a table or an equivalent base for example, having bearing means, a motor driven grinding wheel mounted on said foundation adjacent to said means; a stand cooperable with said grinding wheel and embodying a vertical spindle at its bottom journaled for rotation in said bearing means, a first horizontal arm mounted atop said spindle, upright means adjustably mounted on and rising vertically from said first arm, and a second horizontal arm mounted atop said upright means; a chuck-assembly embodying a chuck in which the stem-end of a twist drill is adapted to be clamped, a shaft connected to and axially aligned with said chuck and having a hand-wheel at its actuatable end for oscillating and sliding the chuck; and holder and guide means for said chuck-assembly adjustably mounted on said second arm.

2. For use in grinding and sharpening twist drills, an apparatus comprising a horizontal stationary foundation, a table or an equivalent base for example, having bearing means, a motor driven grinding wheel mounted on said foundation adjacent to said bearing means; a stand cooperable with said grinding wheel and embodying a vertical spindle at its bottom journaled for rotation in said bearing means, a first horizontal arm mounted atop said spindle, a standard adjustably mounted on and rising vertically from said first arm, and a second horizontal arm mounted atop said standard; a chuck-assembly embodying a chuck in which the stem-end of a twist drill is adapted to be clamped, a shaft connected to and axially aligned with said chuck and having a hand-wheel at its actuatable end for oscillating and sliding the chuck; and holder and guide means for said chuck-assembly adjustably mounted on said second arm, said holder and guide means being shiftable toward and from said standard and having a bushing in which said chuck is removably, slidably and turnably mounted.

3. The structure defined in claim 2 and wherein said bushing is adjustably mounted and supported in axial alignment with said chuck, that end of the bushing which is nearest to said chuck constituting a gauge-like stop; and said chuck-assembly having a collar thereon functioning as a final-position denoting limiting stop for said chuck-assembly when the chuck embodied therein abuts said first named stop.

4. The structure defined in claim 3 and wherein said holder and guide means is provided with turn-pin rests, said collar having turn-pins alternatively engageable with said turn-pin rests to check the intermittent left-to-right turning movements of said chuck-assembly.

5. The structure defined in claim 4 and in combina-

tion, and mechanical means for progressively pivoting and swinging said stand about the axis of said spindle whereby to swing the chuck-assembly and drill in a manner to bring about and achieve the standard recommended clearance of approximately 12°.

6. The structure defined in claim 5 and, in combination, a bed plate fastened atop said foundation and interposed between the foundation and first named arm, said plate having radial degree-indicating-lines thereon, said arm having an index and the latter registering selectively with said lines, and also having a bearing hole registering with the bearing means in said foundation.

7. For use in grinding and sharpening twist drills, an apparatus comprising a stationary base, an assemblage which is vertically liftable and lowerable and comprises a multi-part stand having a spindle at its lower end which is turnable in the bearing means provided therefor in said base and also vertically adjustable, said stand embodying a first horizontal arm, a frame having a lower portion slidably and rockably adjustable on said arm and rising vertically therefrom, a plate cradled for movement in said frame, a second arm carried by and extending laterally from said plate, a bracket adjustably mounted on said second arm, chuck means adjustably mounted on said bracket, said chuck means being adapted to accommodate a drill, and said drill passing through a hole provided therefor in said plate.

8. The structure defined in claim 7, and a dial having a stub shaft mounted for rotation in a bearing provided therefor in said plate, said dial being marginally provided with circumferentially spaced graduated holes therein for selective reception of an end portion of the drill.

9. The structure defined in claim 8 and wherein said frame is adjustable longitudinally of the first named arm and is also rockable clockwise depending on varying requirements of the user.

10. For use in grinding and sharpening twist drills, an apparatus comprising a horizontally disposed stationary base, a motor driven grinding wheel mounted on said base, a stand structure pivotally mounted on said base, a chuck-assembly, means adjustably bracketing said chuck-assembly on said stand, and a drill stabilizing member mounted on the stand and interposed between the stand and said grinding wheel and serving to accommodatingly support and rigidify a portion of a drill which is adapted to cooperate therewith while said drill is being ground, and comprising a rotatably mounted disk, (said disk being provided with circumferentially spaced peripherally arranged holes, said holes each varying in a gauge depending on the particular caliber or cross-section of the drill which is adapted to cooperate therewith, said drill assembly comprising a chuck the axis of which is intended to be axially aligned with one of the holes in said disk, a shaft for advancing and turning the chuck, and mounting and guiding means therefor.

11. For use in grinding and sharpening twist drills, an apparatus comprising a horizontally disposed stationary base, a motor driven grinding wheel mounted on said base, a stand structure pivotally mounted on said base, a chuck-assembly, means adjustably bracketing said chuck-assembly on said stand, and a drill stabilizing member mounted on the stand and interposed between the stand and said grinding wheel and serving to accommodatingly support and rigidify a portion of a drill which is adapted to cooperate therewith while said drill is being ground, and comprising a rotatably mounted disk, said disk being provided with circumferentially spaced peripherally arranged holes, said holes each varying in gauge depending on the particular caliber or cross-section of the drill which is adapted to cooperate therewith, said drill assembly comprising a chuck the axis of which is intended to be axially aligned with one of the holes in said disk, a shaft for advancing and turning

the chuck, and mounting and guiding means therefor, said means comprising an adjustably mounted bushing in which the chuck is fitted for sliding and rotation, and a collar mounted on said chuck.

12. The structure defined in claim 11 and in combination, a rack supported from said base, and a pinion mounted on said shaft and in cooperating relationship with the teeth of said rack.

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