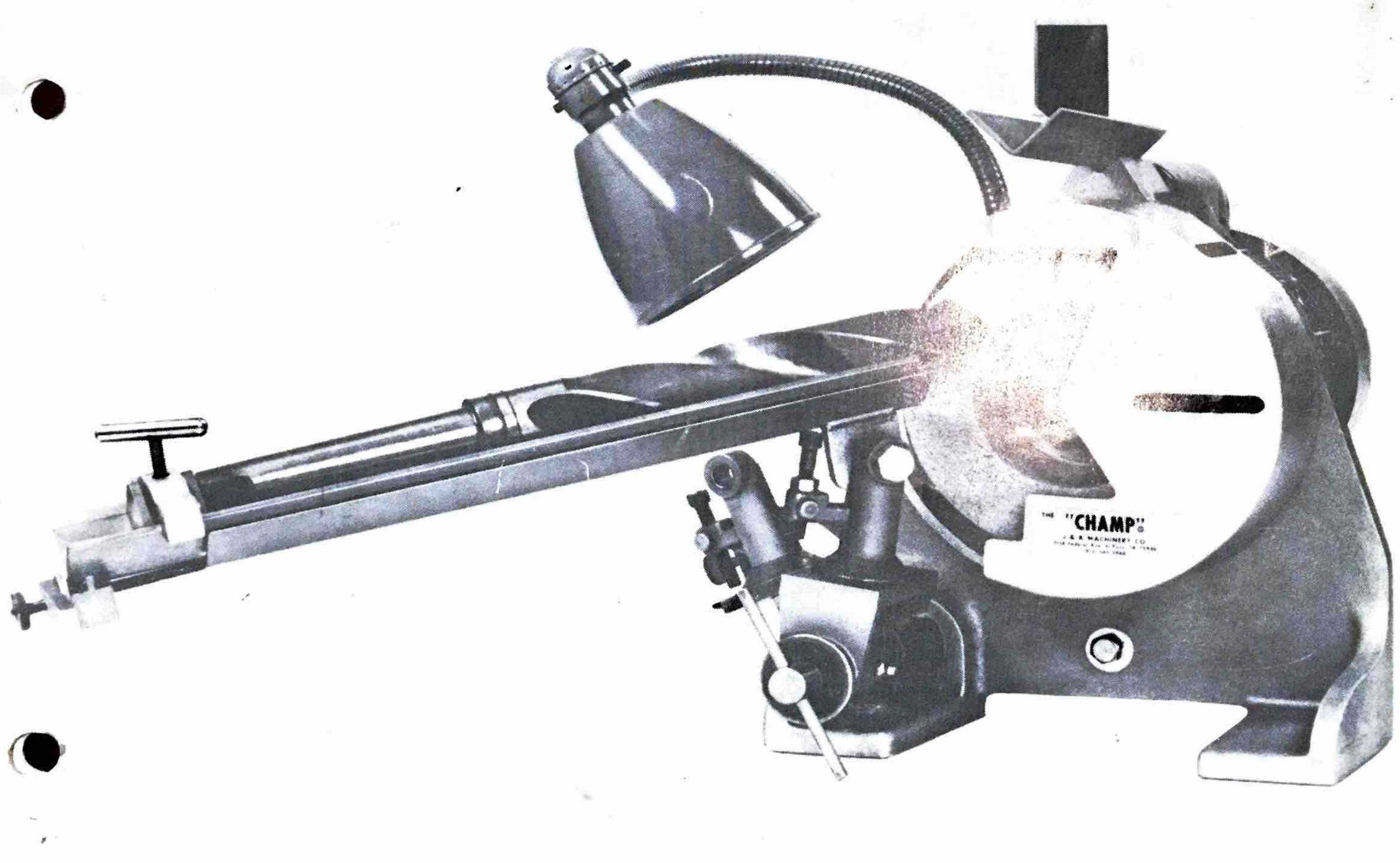
INSTRUCTION MANUAL
and
PARTS LIST

J & A DRILL GRINDING EQUIPMENT
CHAMP® SERIES



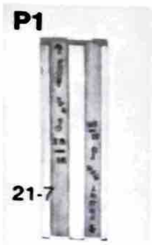
INSTRUCTION MANUAL

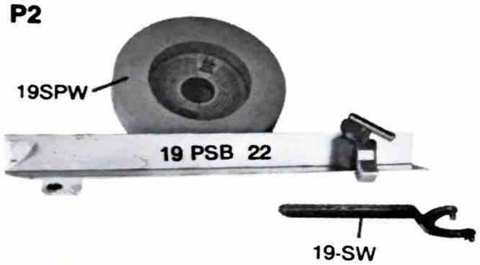
This equipment produces extremely accurate results, PROVIDING THE OPERATOR FAITHFULLY FOLLOWS INSTRUCTIONS.

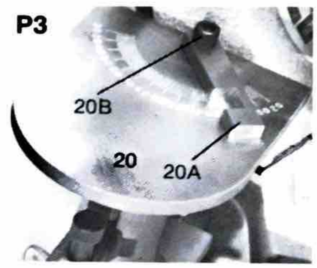
BEFORE USING THIS MACHINE, **FIRST** BE SURE THE WHEEL IS TIGHTEND AND THEN TRUE THE WHEEL with the dresser (19) sweeping the full length of the SLOTTED HOLES in the wheel cover. (Keep adequate thread tension on dresser's threaded shank.) Follow all industrial, OSHA, and other recommended safety practices while operating **THIS** equipment.

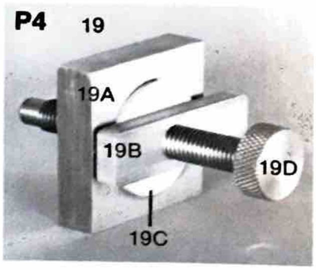
Below, the arrows on the grinding wheel show the wheel's correct rotation.

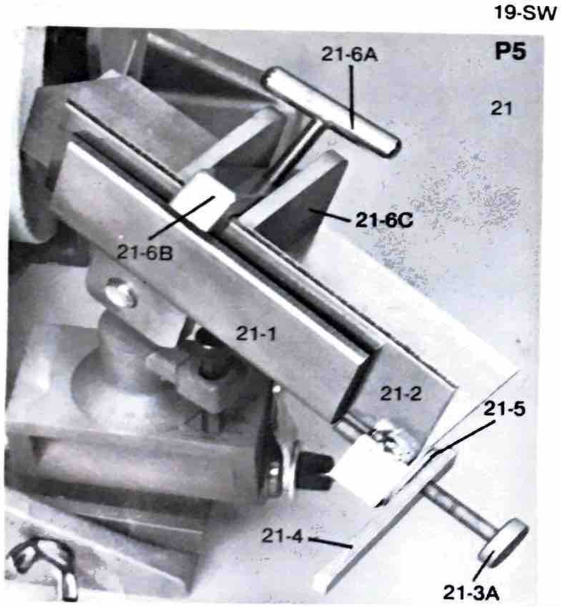
All single phase motors are wired for 110 V. For other voltages, see wiring schematic plate riveted to motor housing. 3 phase motors must be wired at purchasers' destination by a licensed electrician in accordance with local electrical codes.

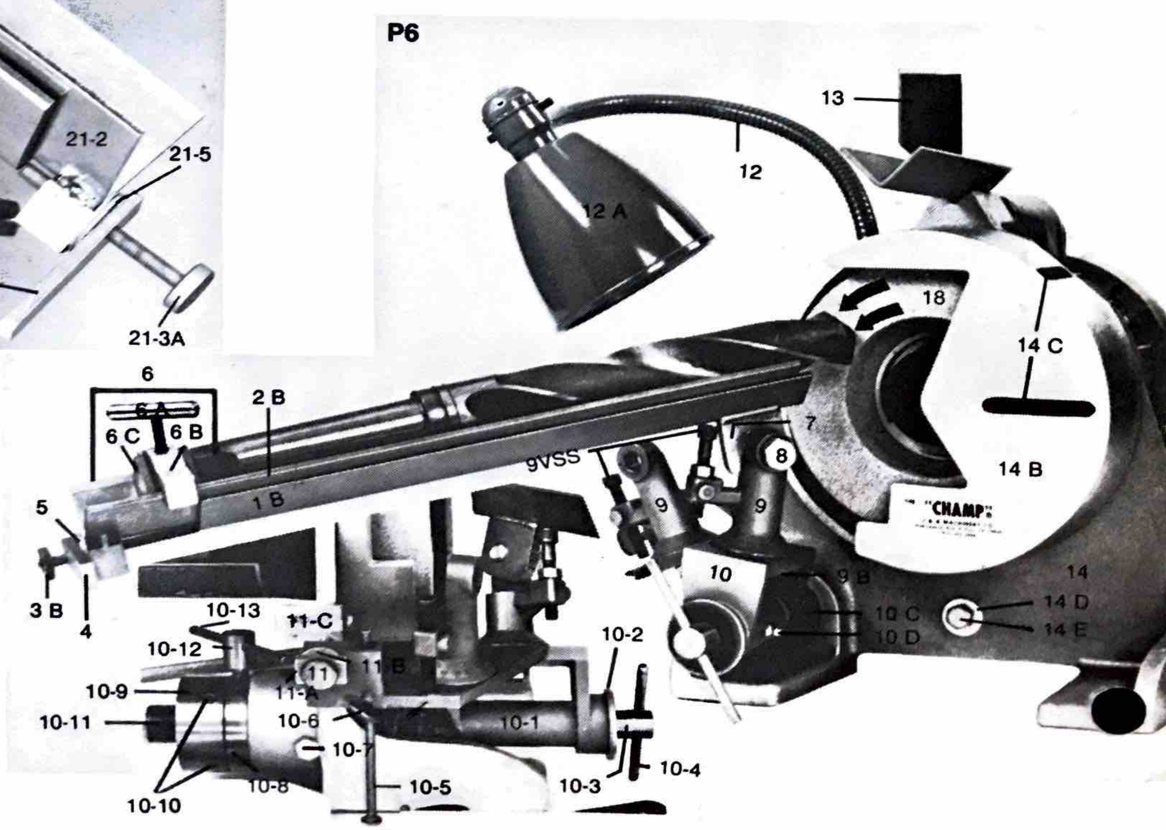






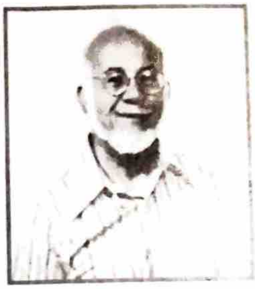






DRILL POINT GEOMETRY

by JOSEPH MAZOFF



Mr. Joseph Mazoff, inventor, member of the Society of Manufacturing Engineers and president of J & A Machinery started his metal crafts career in Pennsylvania as a young apprentice nine years old in a black smith shop in 1926. In 1938 at age 18, competing against more than 300 experienced competitors in their fifties and sixties, Mr. Mazoff took first place in the Pennsylvania state wide tool grinding contest, including twist drill sharpening.

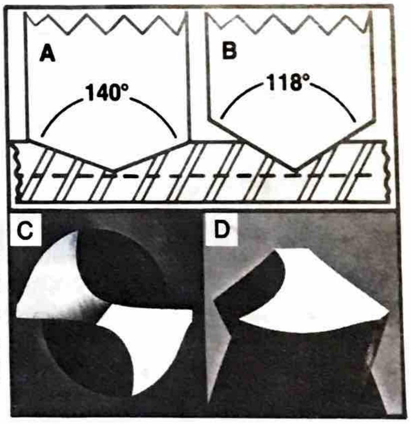
Mr. Mazoff has lectured on Drill Point Geometry in various universities such as Brigham Young and other teaching institutions in nationwide states such as Texas, Kentucky, Pennsylvania, Ohio, New Mexico and other states.

Mr. Mazoff has also conducted Drill Point Geometry seminars at large machine shops at major industrial plants such as Pratt & Whitney at East Hartford, Connecticut, General Electric at Schenectady, N.Y., The Abex Corporation, The Philadelphia Naval Shipyard & other major installations that have large machine shops.

Also, Mr. Mazoff authored an 11 page article titled "Choose the Best Drill Point Geometry" which was printed in the June 1989 issue of "Modern Machine Shop" magazine. (Reprints of article available by contacting "Modern Machine Shop" magazine.)

Back in the Appalachian Mountains where the author started his career in a blacksmith shop, electricity was unknown. Consequently, when drilling holes manually with 1½" diameter drills, such drilling was painstakingly slow, requiring much time, patience and physical effort. Therefore, through experimentation; it was established that once a conical (conventional) surfaced drill was ground with a flat surface (multi-faceted point); it produced a linear chisel which required 150 percent less thrust than a conventional drill. However, as manual proficiency to grind multi-faceted points declined down through the years, such points declined accordingly because they are extremely difficult to grind by hand. However, due to the recent advent of NC machinery that demands self centering points, multi-faceting has been revived to meet the demand.

As you will note in the pages that follow, a most important feature of multi-faceting is the wide variety of drill points it permits to better serve the craftsmen's needs; especially in this modern age of exotic metals. Exotic metals are indispensable, compelling our craftsmen to adapt to more up to date Drill Point Geometry. Hence, the purpose of this article is to inform and update craftsmen on this superior type of drill point geometry with its greater variety of geometrical patterns for more advantageous applications. Other aspects of drill point geometry will be covered that are rarely or ever covered in print since practically all drill point data deals with the same meaningless information telling craftsmen that "It's important to Keep Drills Sharp." Instead, this article elaborates on how to sharpen drills for best results and to clarify long standing unproductive misconceptions.

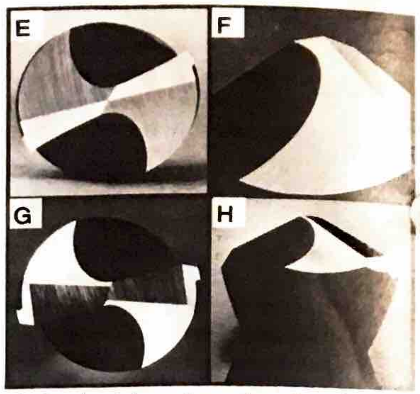


The drill is the most important, least understood, and most neglected of all cutting tools, and, we accept drill point standards, based on inflexible precedent rather than logical deduction and experimentation. As an example, craftsmen assume that the 118° point is a good compromise or general purpose point for drilling a variety of different metals and this erroneous information appears in machine shop textbooks. Varying the point angle has nothing to do with cutting action. The 118° point is pure myth. In reality, a compromise between high and low lip clearance angles is the determining factor for a general purpose cutting tool, NOT the (non-cutting) point angles. On the other hand, when lip clearance angles are compromised, we are bucking the "laws of physics". Meaning that if we compromise the cutting edge of an ax, it will do a poor job to either shave a beard or split a log. Thus, lip clearance angles must be adjusted to the metal's degree of hardness and machineability. GENERALLY, less clearance for hard metals and increased clearance for softer metals accordingly.

As to drill point angles, note in fig. A, that the full length of the cutting lips are involved in cutting action while in fig. B, only 64 percent of the lips length are involved in the same depth of parent metal. Maximum rate of penetration into metal occurs only when the full length of the cutting lips are involved in the material. Thus, the more blunt the point, the sooner the lips are involved in full cutting action. Although figures A and B have the same width denoting the same drill diameter, the more blunt point of fig. A has shorter over all cutting lip lengths than fig. B's. This means that fig. B would drill the same size hole but with longer lip lengths and a wider ribbon, thus creating more torque for the same size drill. Specifically, the lip length of a 1" diameter drill with 140° included angles will measure 9/16" per lip and the same drill with 118° included angles will measure 39/64" length per lip. Multiplied by both cutting edges, the 1" drill with 118° included angles is the equivalent of drilling with a 3/32" larger diameter drill. With larger drills, the spread is markedly increased.

Note in Fig. D that the chisel's profile is flat (linear) running straight across the drill, forming sharp acute angled corners where the chisel ends join with the web surface. When drilling a hole, the chisel's full length contacts metal and the chisel's corners simultaneously augurs into the metal, immediately producing chips. Furthermore, the flat ground facets produce a prounounced sharp edge on the chisel as seen in Fig. C. As a result, the chisel has outstanding extruding properties permitting less thrust, less heat, and greater productivity than the conventional drill. The conventional drill has a bow shaped (non-linear) chisel which literally wears a saucer shaped depression in the metal for the full depth of the hole. In stainless steel, frictional heat is sufficient to turn such a drill blue, generating temperatures over 1000°. With rounded surfaces on each side of the conventional drill, it has poor extruding properties, calling for high thrust pressure.

In drilling operations, the by-products of rotational energy is chips and heat; either high heat and less chips or less heat and more chips. Multi-faceted geometry generates the least amount of heat of all the drill point patterns. In comparing two drills of the same diameter, the multi-faceted drill features 150% less thrust and 70% less heat than a conventional drill.



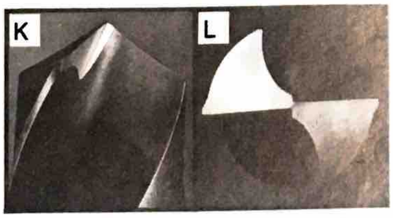
Four faceted drill points consist of separate cutting lip (primary) and secondary heel clearance (relief) facets (fig. E) and extending the secondary facets to the midway point of the chisel produces the apex (point) (fig. F) at the center of the chisel's long axis. As a result, it produces a self-centering point, eliminating center punching and pilot holes. It won't walk, and is the most accurate of all points. It's especially applicable to NC machines, matched holes on dies and can be ground on the largest of drills. Primary facet angles is determined by the nature of the material being drilled while secondary facet angles are at 20°.

The 6 faceted drill with secondary point angles (SPA) is the most durable of points, but least understood and utilized. The 5th and 6th facets form secondary drill point angles (fig. G & H). The weakest area of the point is the outside cutting lip corners which are also exposed to the greatest amount of stress and travel. Consequently, drill points break down most frequently at those corners. Secondary point angles reduce those acute angles (fig. H) to reduce corner breakdown, and consequently, reduces regrinding frequency which increases drill life. By actual tests in our shop, we have obtained as high as 700% more holes than a conventional conical ground drill. At the Ford Motors Engine Plant in Ohio, the computer indicated an expected life cycle of 8000 holes. However once the same conventional drills were reground with the fig. H chamfered point, the computer printout showed a productivity of 31,057 holes. In compliance with my recommendation that Ford Motors reduce the cutting edge clearance, productivity increased to 37,100 holes at which time the drilling project was completed; but the drills were still in excellent condition. The attributing factors for such a sharp increase in productivity was the flat grind combined with the chamfered corners in G and H. Metal being drilled was cast iron. Secondary point angles also produce secondary cutting lips that angle toward the heel corners (fig. G). As the drill rotates, the back angle of the secondary lips cuts metal with a slicing action which further reduces lip corner breakdown and less drag, heat, drill torque, and less binding as the drill exits from the hole. This point is ideal for core holes and tubular material, producing burr free holes. There is also greater hole accuracy since the secondary point angles offer a self-seating, reaming action that resists lateral pressures. In addition, this point has good chip breaking properties since the primary and secondary cutting edges in fig. G, produces an angular formed ribbon that breaks more readily as it curls against the flute surfaces. The amount of degrees that's gound on the secondary point angles is determined by what angles were ground for the primary point angles. The rule to follow is to split the angles evenly. As an example, if one side of the primary point angle is 67°, then the secondary would be half of that or 33½ and etc. This splitting of the angles is best seen in fig. H. However, there are some exceptions in splitting the angles such as plastics, in which case, the secondary angles should be decreased (more spearshaped). As to lip clearance angles of secondary cutting lips, they are generally the same as the primary lip clearance angles SPA can be added to all other points for increased accuracy and durability.)

The conventional split point (CSP) is highly productive but is limited since it cannot be utilized on drills beyond ½" dia. In addition, the neutral corners of the CSP impedes the escape of the chips resulting in a weld bead that has a tendency to neutralize the advantages of the CSP. Furthermore, the CSP is a most exacting and critical geometry to re-grind at the local shop level. However, the Modified Split Point (MSP) (figs. I and J) doesn't have the shortcomings of the CSP since re-grinding the MSP is not a critical operation. Furthermore, the MSP is a far more productive point. In fig. J, note that the webb's notch has a positive rake, resulting in secondary positive cutting edges up to the chisel, thereby increasing drilling efficiency. Also note that the secondary cutting edges blends into the primary cutting edges with less acute angled corners, thereby permiting the MSP to be ground on drills up to 3" in diameter. The chisel length (fig. I) can be reduced accordingly to a length of 0.050" for 3" diameter drills down to 0.010" for ¼" drills, resulting in unparalelled extruding properties; permitting the cutting edges to bite deeper in to the metal for thicker chips. The MSP produces a self centering drill which eliminates pilot holes even for 3" diameter drills. Notches are ground parallell to the flute angles (fig. J) which permits self cleansing notches, allowing chips to flow freely up the flute. With the notch on the opposite webb angling diagonally up and away from the other notch, the webb thickness is not compromised, thereby permitting a stronger point that allows increased thrust to drill holes more rapidly. As a result of these features, the MSP developed by the author is superior to the MSP produced by Renault-Peugeot or other sources.

Using the Swedish IMA drill press with controlled feed and speed settings, our company confirmed that the Modified Split Point produces 3 to 5 hundred percent more holes than the Conventional Split Point and 7 to 8 hundred percent more holes than new factory ground conventional drills. Written testimonials from other reputable sources confirms J&A Machinery's findings. Modified Split Points also generate the least amount of heat of all twist drills. An article entitled "Pointing Towards High Drilling Rates" published in the June 1982 issue of Modern Machine Shop magazine, page 85, showed a thrust chart with the following information. At a feed rate of 0.027 IPR and four different drill points being the same diameter of 1.57 inches, the conventional drill required the most thrust, over 5,000 pounds while the MSP Renault-Peugeot point (R.P.) required the least amount of thrust, 2,000 pounds to drill the same size hole. However, the MSP developed by Mr. Mazoff of J & A MACHINERY CO. requires 165% less thrust than the RP point to drill the same size hole.

In sharpening the MSP, chisel lengths are varied, ranging from 0.050" on a 3" diameter drill down to .010" on a ¼" diameter drill. The rake across the webb (the notch) can be varied, ranging from 5° positive for the softer materials to a 5° negative for the hardest materials. The MSP is especially outstanding for stainless, inconel, titanium and other difficult metals. The MSP is also self-centering, eliminating pilot holes.



The Dubbed drill (fig. K) can be used for drilling many materials in addition to brass and copper. Conventional twist drills have maximum positive rake (angle or pitch) of the flutes at the outer extremes of the cutting edges and gradually approaches a neutral or slightly negative angle at the webb center, depending on the drill's helical nature. This results in cutting edges with variation in cutting action, reduced to it's minimum in the vicinity of the drill's center and excessive at the outside lip corners where there is the greatest degree of rake and rotary travel. This situation puts the cutting edges in the OD area under tremendous stress and is a primary reason for lip corner breakdown. However, dubbing the flute surfaces produces uniform rake angle across the full length of the cutting edges (fig. K), thereby increasing cutting action in the central area of the drill where it is normally minimal and gradually decreased toward the OD where it is normally excessive. This results in more equalized distribution of cutting action across the lips full length, thereby reducing corner breakdown while markedly increasing drilling efficiency. In fig. L, note the dubbed cutting edges have reduced the chisel's length. Therefore, a dubbed drill is also self centering, eliminates webb thinning, center punching and pilot holes. The notches on this drill also angle away from each other like the MSP to preserve the thickness of the webb's central surface for greater strength against crushing forces.

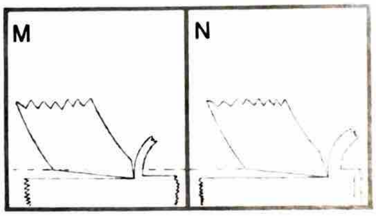


Fig. M and N are cross sections of dubbed rake angles, but note that the lip relief angles remain unchanged in both figures. However, the cutting edge in fig. N is producing the thicker chip because of an increased rake of the dubbed flute surface. Such geometry produces a planing action due to low lip relief angle which reduces hogging-in and drill chatter, thereby increasing productivity and accuracy. A reduced chisel as in fig. L and increasing or decreasing the rake accordingly permits a dubbed point to drill hard or soft metals, bakelite, fiberglass, plexiglass, copper or brass. When drilling very soft copper or brass, use 5° negative rake and as metal hardness increases, adjust the rake accordingly towards a positive rake angle.

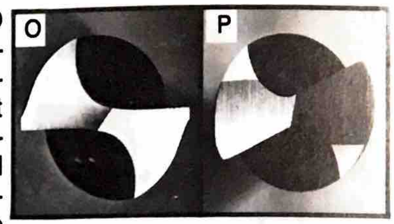
Drills with unequal lands are quite common and they are simply IMPOSSIBLE to grind properly since the cutting lips are not at opposite positions of 180° from each other. Needless to say, such drills, even new ones will NOT drill efficiently or accurately. Equally deplorable and common are drills with unequal flute to flute surface configurations. However, dubbing such drills will dress out the differences, therefore leaving dubbed lips at a precise opposite 180° position from each other and uniform configuration of flute to flute surfaces. An additional problem are the numerous flute surfaces that have rough serrated surfaces that results in saw toothed cutting edges that break down more readily. Dubbing also solves this problem, producing smooth uniform surfaces on such drills, thereby increasing lip life.

For stainless steel, drills are ground with 140° included drill point angles and 10 to 12° lip relief angle facets which assure more positive cutting action while the blunt 140° point assures maximum lip involvement in the earliest possible time. The key to drilling stainless steel is to avoid work hardening by obtaining maximum cutting action in minimum time. The recommended point is Fig. I in page 2 and secondary point angles (Fig. H, page 2) to strengthen the lip corners. The secondary cutting lips constitute 10 to 15 percent of the lips overall length. The notch (Fig. J P2) may vary from 5° positive notch for soft stainless, neutral for semi-hard and 5° negative for hard exotic metals.

Plastics are notorius to drill; demanding the highest degree of drill point accuracy; and especially the most blunt of all points. 1/8" thick plexiglass was drilled at 35°Farenheit above zero with different variety of drill diameters and point angles. Beginning with 80° included angle drill points, the material would shatter every time as the drill point began to emerge through the bottom surface of the material. As the point angle was increased (more blunt), destruction of the plexiglass was reduced accordingly. At 134°, breakage was markedly reduced. At 142°, there was no breakage. Chipping around the bottom shoulders of the hole as the drill exits was eliminated with secondary point angles (Fig. I, page 2). In this case, the secondary cutting lips were 20 percent of the overall lip length. Therefore, it was concluded that the recommended 60 to 80 included angle points were the most destructive in drilling plexiglass. With such a spear shaped point, when the drill begins to emerge from the materials, a small irregular circular shaped hole with feathered edges develops in the bottom surface. Consequently, the spear-shaped cutting lips wedge into the feathered edges at right angles, causing a binding and locking action that instantaneously shatters the material. On the other hand, a blunt point with less wedging action exits more gradually with its cutting lips more parallel to the feathered edges. In essence, the recommended 60 to 80° point standards for drilling plastics have no scientific merit. In the final analysis, the most effective point consisted of 144° included angles for the primary point, 80 to 85° included secondary point angles, 4 to 5° primary lip clearance angle facets and 20°secondary heel clearance facets. (Twenty degree heel clearance facets are automatically ground whenever primary angle facets are 8° or less). The general rule is that as the primary facet angles are reduced, the secondaries are increased accordingly as in figure P, page 4. Thus, blunt drill points with lip clearances adjusted for specific materials have equal application on hard and soft ferrous, non-ferrous, and some non-metallic materials.

Excessive lip clearance is extensively practiced throughout the U.S. In fragile material, it causes severe hogging in and material destruction. Also, it produces over-sized holes and is a primary cause for reduced cutting edge life. Such excessive clearance is due to the tendency to incorrectly view the drill as shown in Fig. D. (P 1). In viewing that drill, most readers would insist that the drill has little or no lip clearance. However, it's an optical illusion since that drill actually has a high clearance of 15°. Never the less, practically all craftsmen try to determine lip clearance by looking directly into the drill as in Fig. D. In doing so, one is looking into a compound angle, looking at the overall surface of the drill rather than a side PROFILE of the cutting edge itself.

HOW TO VIEW LIP CLEARANCE ANGLE. An eyeball method that's fast and positive is to read the chisel line angle (chisel's length). If the chisel's line angle is on a vertical plane pointing to 12 o'clock (90° in relation to the cutting edges on a horizontal plane, lip clearance would be zero. But as lip clearance is gradually increased, the chisel line inclines diagonally to the right accordingly towards 1 o'clock. (fig. O). Therefore, by paralleling the cutting edge with a protractor, a reading of 110° of the chisel line angle denotes approximately 5° or low clearance; 120° indicates 8° or medium clearance, 130° indicates 11° or high clearance, and 135° indicates extra high clearance. With some practice, a glance will instantly reveal the clearance status quite accurately without a protractor.



HOW MUCH CLEARANCE DO WE NEED? Using a two faceted drill as fig. O for example, slight impingement about 1/32" in size first occurs at the rear outside heel corners when constant lip clearance is reduced down to 7°. At 5°, impingement is approximately 1/16" in size, and further clearance reductions result in a triangular shaped impingement radiating primarily toward the lips and secondarily towards the chisel. Therefore, a small secondary facet (fig. P) is required only when the constant clearance is 8° (medium clearance range) and the secondary facet size is increased gradually toward the cutting edge (fig. G P1), as the primary lip angle is reduced accordingly down to the 5 to 3 degree range (low and extra low clearance range).

In selecting the correct lip clearance angles, it requires analyzing the material's machinability, hardness, brittleness, fragility, etc. Since drill chatter and hogging in can be detrimental to both drill and material, it obviously demands reduced clearance in a fragile or hard material. Reduced clearance produces a smoother and more accurate hole while permitting increased drilling speeds to compensate for chip thinness.

A FINAL NOTE ON PRODUCTIVITY: In the early fifties, the author was involved in introducing the dental profession to high speed air turbine mandrels that allowed dentists to drill out tooth decay at least 500 percent faster than with the former gear driven mandrels. In short, the metal fabricating industry is behind the times, losing countless millions of dollars due to low speed drilling operations. High speed and flood cooling is the ultimate answer for high productivity. However, drill presses must be in top condition with absolute accuracy. Readers should be forewarned that factory ground drills generally do not meet such accuracy requirements due to mass production; and also applies to various drill sharpeners that lack proper mechanical design and concepts to assure the extremely high degree of accuracy. In drilling operations, J & A Machinery normally utilizes speeds 300 to 400 percent higher than recommended in the handbooks. Handbooks must recommend lower speeds because of inaccurately, manually resharpened drills and run-out on worn drill presses.

Spades blades utilize the same geometry of this article and they are fabricated with more blunt points, therefore offering the users the advantageous features as reflected in this article. The spade blade has numerous superior advantages over twist drills; such as permitting a more open channel for the coolant to reach the cutting area in the hole, elimination of woodpeckering in deep holes and excellent chip breaking properties. And since the spade blade holder is a thick walled tubular structure, it possesses superior torque properties, therefore permitting much deeper holes than twist drills. In addition, one holder can accomodate up to eight different sized blades, thereby drastically reducing both cost and storage space to a fraction of eight twist drills. And since holders are produced in different lengths, the operator has more flexibility to meet specific drilling requirements. A primary objection to greater use of spade blades has been the expensive and time consuming resharpening operation. However, J & A Machinery Company's drill grinder rapidly sharpens spade blades.

In most American machine shops, drills are in the most deplorable condition of all cutting tools, namely bent drills, with excessively thickened webs, large nicks and chips of the cutting edges, badly worn margins, scored and distorted shanks and cheap quality drills. It should be noted that top quality work demands top quality drills. Top quality drills are all the more important, considering that drilling operations lead all other fabricating steps. Drilling operations exceed milling, bending, stamping, turning and all other operations. It's impossible to calculate monetary loss as a result of unproductive drills in our nation's metal working shops. This monetary loss is compounded due to scrapping costly finished work pieces, nullified by the final step, the drilling operation, further compounded by a general lack of knowledge on drill point geometry; thereby failing to take advantage of the best geometrical patterns. The drill is simple in appearance but complex in function.

J & A Machinery manufactures the "CHAMP" Multi-Faceting machine that grinds all the points listed in this article and though it's unequaled in price and drill capacity, readers are urged to compare the CHAMP against all other multi-faceting machines to satisfy themselves. Be sure to compare the price, capacity, and ask competitors if they can grind the positive notched Modified Split Point.

Additional copies of this article are available at no charge by contacting:

J&A Machinery., 3136 Federal Ave., El Paso, Texas 79930 — 915/565-2868

INSTRUCTION MANUAL

NOTE: This is the parts list for the single Tool Post (#9 below). Single Tool Post machines as this one cannot split the point. The machine shown on the front cover containing 2 tool posts can split the point. However, with exception of splitting the point, operational instructions apply to both models.

This equipment produces extremely accurate results, PROVIDING THE OPERATOR FIRST BECOMES THOROUGHLY FAMILIAR WITH THIS MANUAL AND ADHERES FAITHFULLY TO INSTRUCTIONS. **DO NOT** ATTEMPT DRILL SHARPENING UNTIL YOU READ THE ENTIRE MANUAL. For satisfactory results, knowledge of drill point geometry is a MUST!!

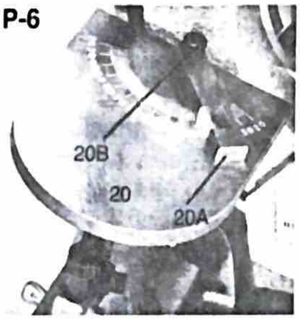
BEFORE USING THIS MACHINE, **FIRST** TRUE THE WHEEL with the dresser (19) sweeping the full length of the SLOTTED HOLES in the wheel cover. (Keep adequate thread tension on dresser's threaded shank.) Follow all industrial, OSHA, and other recommended safety practices while operating **THIS** equipment.

Below, the arrows on the grinding wheel show the wheel's correct rotation.

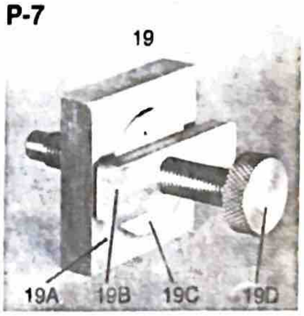
All single phase motors are wired for 110 V. For other voltages, see wiring schematic plate riveted to motor housing. 3 phase motors must be wired at purchasers' destination by a licensed electrician in accordance with local electrical codes.

P-5

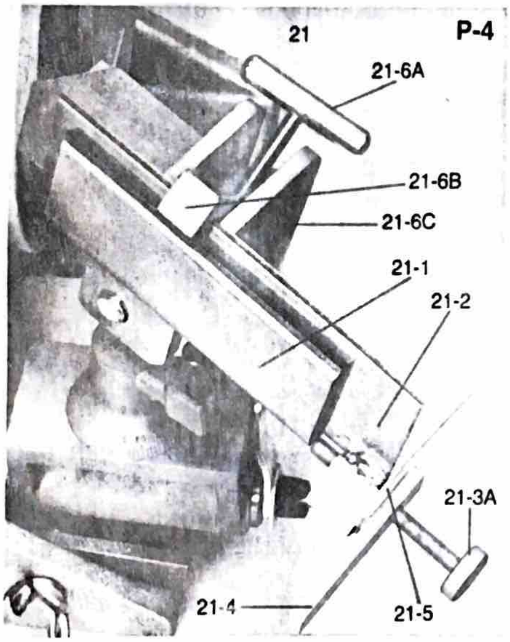
P-6



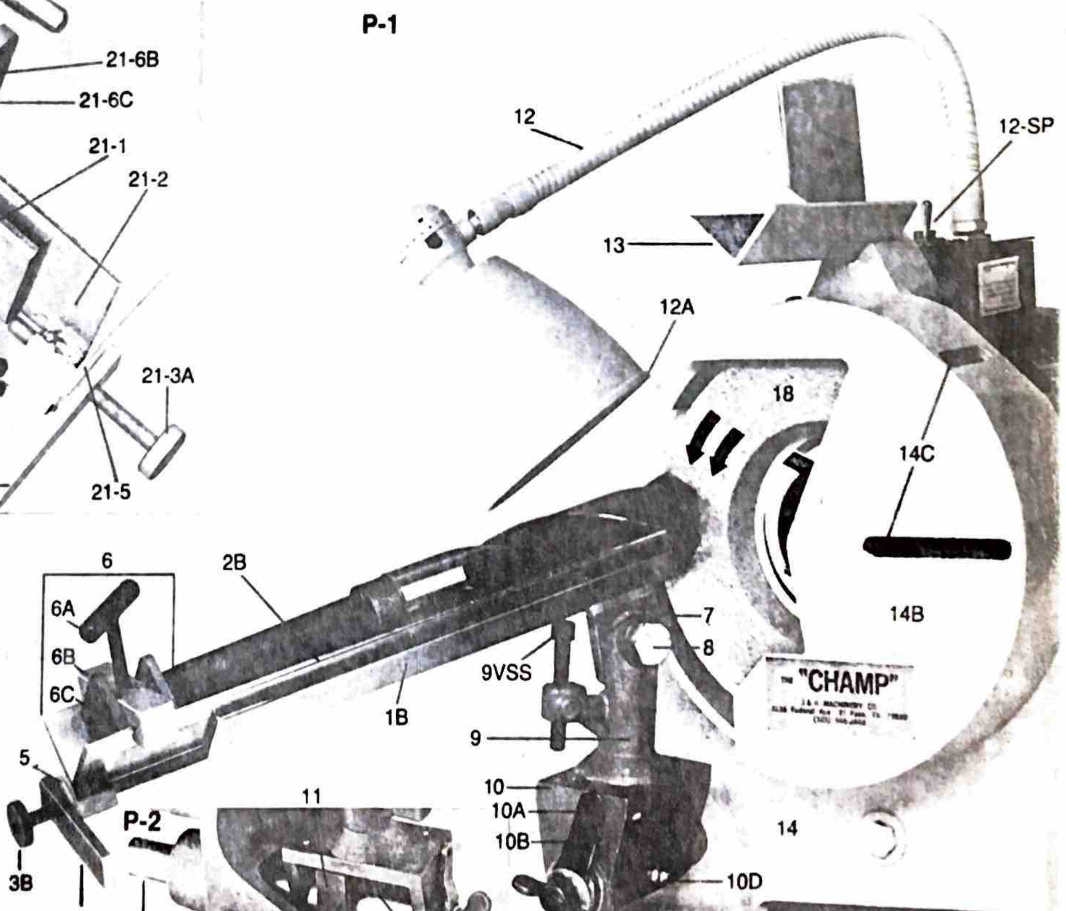
P-7



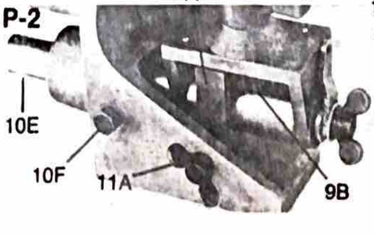
P-4



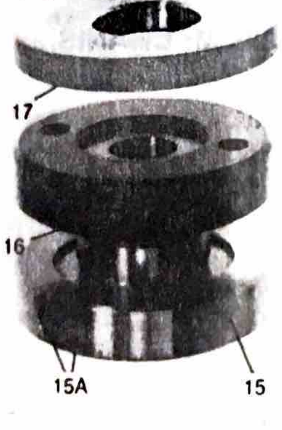
P-1



P-2



P-3



PARTS LIST AND THEIR FUNCTION

1B. CARRIAGE BED. Supports upper drill bed.
2B. DRILL BED. Slides forward with drill to grinding wheel.
3B. KNURLED FEED SCREW. Controls forward drill bed travel to grind drill point.
4. THREAD TENSION BAR. Increases or decreases thread tension of the feed screw.
5. PLASTIC WASHER. Increase thread tension range (MUST be kept clean).
6. DRILL BACK STOP LOCK ASSEMBLY. Adjusts to different drill lengths.
6A. "T" Bar Screw. (On ⅓ HP model only, this part is 6TS.)
6B. Bridge.
6C. Cube.
7. LIP CLEARANCE SCALE.
8. LIP CLEARANCE LOCKING SCREW.
9. TOOL POST. Lower part has ring scale for drill point angles.
9B. Drill point angle locking screw.
9VSS. VERTICAL SHIFT STOP. Prevents heavy drills from shifting 1B downward and also used to obtain precise angles with angle guage blocks when using TOOL TABLE.
10. OSCILLATING MECHANISM. Sweeps drill back and forth across wheel rim's FULL width.
10A. Roll Pin.
10B. Locking Bracket.
10C. Locking Screw. Locks 10 for small drills and certain tool table operations.
10D. Grease Fitting. (Grease at least once monthly, more often for heavier usage.)
10E. Boss Shaft. Adjusts for wheel wear and permits reduced clearance between the wheel and front end of grinding mechanism.
10F. Boss Locking Screw. Locks boss shaft's adjustment. Be sure 10F is locked against flat part of 10E.
11. SWING CONTROL STOP. Keep it in position as shown for drill sharpening and horizontal position when using tool table or spade drill adaptor.
11A. Swing Stop Locking Screw.
12. GOOSE NECK.
12A. Light Shade.
12-SP. POWER SWITCH. 12-SP is for single phase and 12-3P is for 3 phase motors.
13. DRILL INDEXING GUAGE. Establishes correct relationship of drill to the wheel.
14. MOTOR BASE CASTING.
14A. REAR SUPPORT LEG. (behind 14)
14B. WHEEL COVER.
14C. SLOTS. For dressing wheel's face and rim.
15. WHEEL ADAPTOR. Accepts grinding wheel.
15A. Socket head set screws.
16. WHEEL RETAINING FLANGE.
16SW. SPANNER WRENCH. (not shown) Is used for 16 and AUTOMATICALLY supplied with each machine.
17. WHEEL SPACER. For use with diamond or borazon wheels. (Special order item.)
18. GRINDING WHEEL. 18-60 is 60 grit, 18-46 is 46 grit and 18-36 is 36 grit.
19. DIAMOND DRESSER ASSEMBLY.
19A. Diamond Holder. Slides across slotted holes in wheel cover.
19B. Thread Tension Bar. Provides thread tension to hold feed screw adjustments.
19C. Plastic Washer. Increases thread tension range (MUST be kept clean).
19D. Diamond Mounted Screw.

OPTIONAL EQUIPMENT. INTERCHANGEABLE WITH DRILL GRINDING MECHANISM

20. ANGULAR TOOL TABLE. 20A, Fence. 20B, Fence locking screw.
21. SPADE AND TRACK BIT SHARPENER. 21-1, Carriage bed. 21-2, Drill bed. 21-3A, Feed screw. 21-4, Thread tension bar. 21-5, Plastic washer. 21-6A, "T" bar screw, 21-6B, Bridge, 21-6C, Cube. 21-7, Track bit shim. (21-7 MUST be used for track bits).

Specify part No. or items name when ordering replacements. NOTE: All parts are interchangeable with all models with the exceptions as follows: For drill grinding beds that accept drills up to 7" long, part No. for carriage [illegible]s 1-A. Drill bed is 2-A. Feed screw is 3-A. "T" bar screw is 6-TS. For drill grinding beds that accept drills up t[illegible]7" long, part Nos. are as listed in P-1. For drill grinding beds that accepts drills up to 21" long, carriage bed is 1-C. Drill bed is 2-C. Feed screw is 3-C, and Drill Stop Lock numbers are the same as those in P-4. For overseas distributors, specify HP ratings for replacement motors.

PARTS LIST AND THEIR FUNCTION

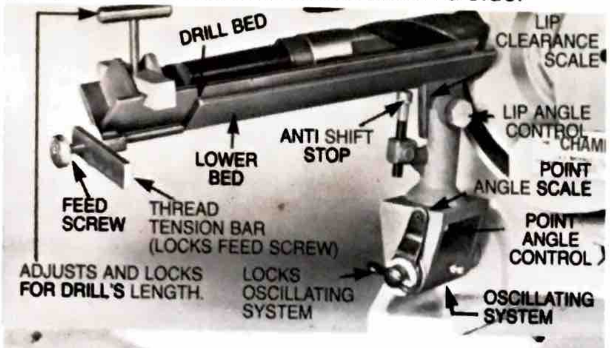
P6— 1B. CARRIAGE BED. Supports upper drill bed.
2B. DRILL BED. Slides forward with drill to grinding wheel.
3B. KNURLED FEED SCREW. Controls forward drill bed travel to grind drill point.
4. THREAD TENSION BAR. Increases or decreases thread tension of the feed screw.
5. PLASTIC WASHER. Increase thread tension range (MUST be kept clean).
6. DRILL BACK STOP LOCK ASSEMBLY. Adjusts to different drill lengths.
6A. "T" Bar Screw. (On 1/3 HP model only, this part is 6TS.)
6B. Bridge.
6C. Cube.
7. LIP CLEARANCE SCALE.
8. LIP CLEARANCE LOCKING SCREW.
9. TOOL POST. Lower part has ring scale for drill point angles.
9B. Drill point angle locking screw.
9VSS. VERTICAL SHIFT STOP. Prevents heavy drills from shifting 1 B downward and also used to obtain precise angles with angle gauge blocks when using TOOL TABLE.
10. OSCILLATING MECHANISM. Sweeps drill back and forth across wheel rim's FULL width.
10C. Boot.
10D. Grease Fitting. (Grease at least once monthly, more often for heavier usage.)
10-1. Swing Casting.
10-2. Locking Disc.
10-3. Locking Screw.
10-4. Locking Lever. Locks oscillating mechanism for sharpening small drills and certain tool table operations.
10-5. Swing Control Rod. Permits positioning of split pointing or drill sharpening mechanism in proximity to the wheel for tool grinding.
10-6. Rod Locking Screw.
10-7. Secures Oscillating Mechanism.
10-8. Oscillating Shaft Guide.
10-9. Feed Knob. Transports tool grinding mechanism towards or away from the grinding wheel.
10-10. 1/4" Set Screw (4) retains ball bearings. Excessively tightened screws makes it difficult to turn the feed knob.
10-11. Oscillating Shaft.
10-12. Shaft Locking Screw.
10-13. Shaft Locking Lever. Used to lock Shaft and Feed Knob.
11. Feed Screw Assembly. Controls depth of notch when splitting points, webb thinning, and etc.
11-A. Thread Tension Nut. Increases or decreases feed screw thread tension.
11-B. Plastic Washer. Increases thread tension range (MUST be kept clean).
11-C. Strike Plate. The amount of clearance between the Strike Plate and Feed Screw TIP determines the amount of metal removal from the drills.
12. GOOSE NECK.
12A. Light Shade.
12-SP. POWER SWITCH. 12-SP is for single phase and 12-3P is for 3 phase motors.
13. DRILL INDEXING GAUGE. (Establishes correct relationship of drill to the wheel.
14. MOTOR BASE CASTING.
14A. REAR SUPPORT LEG. (behind 14, not shown)
14B. WHEEL COVER.
14C. SLOTS. For dressing wheel's face and rim.
P7— 15. WHEEL ADAPTOR. Accepts grinding wheel.
15A. Socket head set screws.
16. WHEEL RETAINING FLANGE.
17. WHEEL SPACER. For use with diamond or borazon wheels. (Special order item.)
P6— 18. GRINDING WHEEL. 18-60 is 60 grit, 18-46 is 46 grit and 18-36 is 36 grit.
P4— 19. DIAMOND DRESSER ASSEMBLY.
19A. Diamond Holder. Slides across slotted holes in wheel cover.
19B. Thread Tension Bar. Provides thread tension to hold feed screw adjustments.
19C. Plastic Washer. Increases thread tension range (MUST be kept clean).
19D. Diamond Mounted Screw.
P2— 19-SPW. This is a special wheel that MUST be used for point splitting and dubbed drills.
19-SW SPANNER WRENCH. For the grinding wheels.
19-PSB This is a special bed that's supplied with the "CHAMP" point splitting machine for point splitting and drill dubbing.
P3— 20. ANGULAR TOOL TABLE. 20A, Fence. 20B, Fence locking screw.
P5— 21. SPADE AND TRACK BIT SHARPENER. 21-1, Carriage bed. 21-2, Drill bed. 21-3A, Feed screw. 21-4, Thread tension bar. 21-5, Plastic washer. 21-6A, "T" bar screw, 21-6B, Bridge, 21-6C, Cube.
P1— 21-7 Track bit shim. MUST be used for track bits).

Specify part No. or items name when ordering replacements. NOTE: All parts are interchangeable with all models with the exceptions as follows: For drill grinding beds that accept drills up to 7" long, part No. for carriage bed is 1-A. Drill bed is 2-A. Feed screw is 3-A. "T" bar screw is 6-TS. For drill grinding beds that accept drills up to 17" long, part Nos. are as listed in P-1. For drill grinding beds that accepts drills up to 21" long, carriage bed is 1-C. Drill bed is 2-C. Feed screw is 3-C, and Drill Stop Lock numbers are the same as those in P-4. For overseas distributors, specify HP ratings for replacement motors.

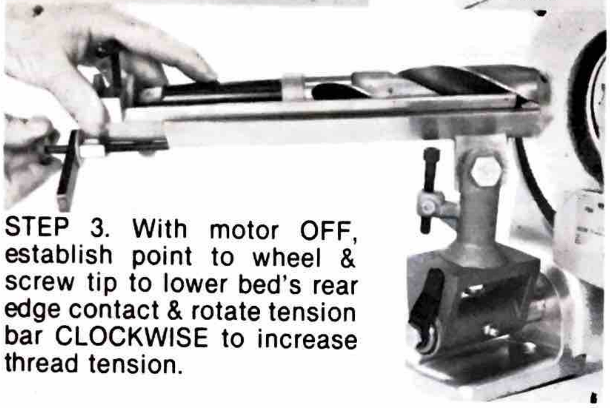
ATTENTION: Items shown in P1, P3 and P5 is optional equipment.

GRINDING STEPS. FOR BEST RESULTS & SAFETY, DUPLICATE HAND & FINGER POSITIONS AS SHOWN.

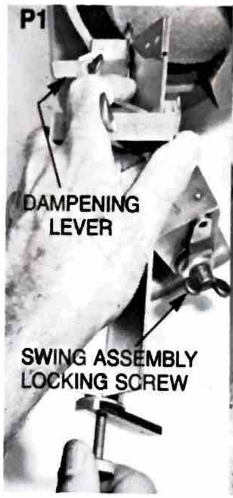
STEP 1. Select desired lip clearance and point angles and elevate anti-shift stop to contact lower bed. For full details on angular settings, see the plaque that's attached to the motor's side.

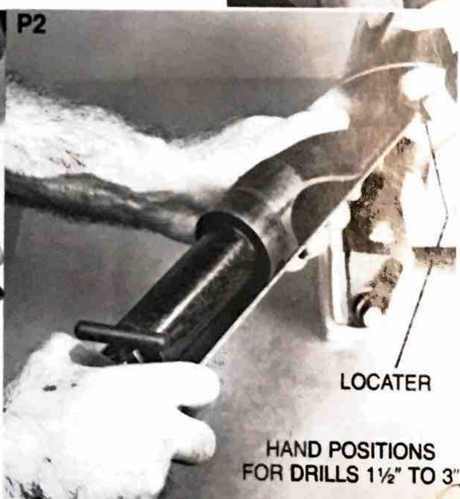


STEP 2: INDEXING →
Begin with left lip DECLINING down across baffle lines and flute edge in contact with Locater's inclined plane. Thumb on LEFT flute edge presses drill lightly against locater. RIGHT thumb applies steady forward pressure on cube to spiral lip into alignment with baffle line. (Avoid point and baffle contact.) For tiny drills, dampening lever (P1) takes place of left thumb. After indexing, LEFT hand carefully tightens Back Stop. Before sharpening the drill, be sure there's contact with flute edge against locater's inclined plane and drill's rear against cube.

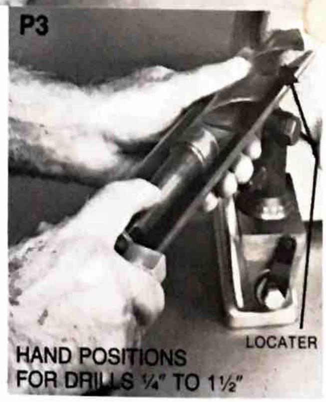


STEP 3. With motor OFF, establish point to wheel & screw tip to lower bed's rear edge contact & rotate tension bar CLOCKWISE to increase thread tension.

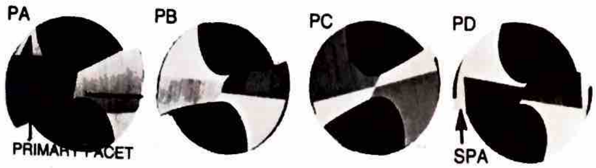




GRINDING DRILLS under 3/16", P1: (For larger drills, proceed to next paragraph). Align drill point in wheel area as shown, lock swing assembly, snug dampening lever firmly against drill's body, start motor and back off feed screw VERY SLOWLY while left hand presses mechanism downward and forward until wheel sparks out. Rotate drill and FIRMLY twist it into locater while PRESSING drill back against cube, retighten lever and job's completed.



GRINDING THE LARGER DRILLS (P2 & P3). HOLD IT!! READ the print in P2 & 3. Draw back Drill Bed to clear the wheel, back off feed screw for metal removal, energize motor and press assembly forward. LEFT hand thumb applies LIGHT pressure on LEFT flute edge to force drill Into locater. DON'T apply pressure on right flute edge, it'll SCREW up the drill. For safety, be sure drill contacts the grinding surface WITHIN rim's width, then sweep drill across rim's full width, being careful not to stray off the rim. Grinding action ceases when wheel sparks out. Wheel will continue to produce light sparks after spark out. True spark out is determined when spark intensity decreases noticeably and grinding sound changes from harsh roar to softer tone. With spark out, rotate drill to complete the job. However, if drills were ground at XLC thru MC, or you desire photo C & D points, proceed to next grinding procedure.



If primary facet, (P A) was ground at MC setting, grind secondary facet (SFC) as follows. Select HC setting on the lip clearance scale, follow step 3, back off feed screw and grind while frequently checking progress until facet size approximates that in P A and wheel sparks out. Then complete opposite side. If primary facet setting was LC, enlarge SFC up to approximate size of white scribed line. If primary facet was XLC, enlarge SFC to approximate size as in P B. **NOTE! To save time, SFC can be ground by hand.**

P C. This self-centering point can utilize XLC thru AC primary facets. Same grinding procedures as with Photo A but be sure wheel sparks out before facet dividing line approaches the chisel's midway point. Then back off the feed screw very slightly several times with spark outs after each feed screw adjustment until the facet dividing line reaches the chisel's midway point. Then rotate drill to grind the other side. **NOTE: Until practice is acquired, it's best to leave facet dividing line a little short of chisel's midway point since it still results in an effective self-centering point. If the facet line is accidently over extended, RE-INDEX and start over.**

P D. Secondary Drill Point Angle (SPA). For primary lip clearances that were ground at AC thru HC, align and lock 90 mark of ring scale with SPA and grind until desired size of SPA and spark out is achieved. Then grind other side. For lip clearances ground at XLC thru MC, *first* complete SFC and RE-SET carriage bed at AC LIP CLEARANCE setting. Then align 90° mark with SPA setting. SPA equals 15 to 25 percent of cutting lip's overall length. **NOTE: SPA can be ground on all types of points. (See instruction manual for more details)**

The following "SPECIAL GRINDING PROCEDURES" are a MUST when converting a standard drill to the flat grind, changing point angles, dealing with excessively ground, badly worn, or broken drills.

BROKEN DRILLS: Extend drill beyond drill bed just enough to expose drill to the wheel and grind a little more than halfway through drill's diameter and spark out the wheel. Then, use the indexing gauge to check the newly ground lip and baffle line alignment. If there is alignment, grind the opposite broken side to complete the job. If there is no alignment, RE-INDEX and re-grind the new cutting edge, spark out and complete the second side. NOTE: Even after a drill is correctly re-indexed and re-ground, always double check the lip and line alignment and repeat CORRECTIVE grinding action again if necessary.

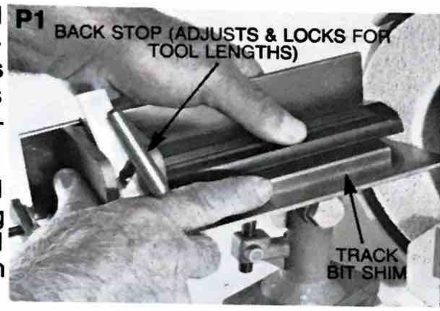
FOR BADLY WORN, OVER-GROUND or conversion of CONVENTIONAL POINTS to the FLAT GRIND. Index as usual and follow above re-grinding and re-indexing procedures.

CHANGING POINT ANGLES: If changing from blunt to a more spear shaped point, OVER-INDEX with the cutting edge angling up across two baffle lines and follow above re-grinding procedures. When changing from spear-shaped to a more blunt point, UNDER-INDEX 2 lines and use the same re-grinding procedures.

INTERCHANGEABLE ATTACHMENTS

Track and Spade bits are extended beyond drill bed approximately ¼" for tool exposure to grinding wheel. Note in P 1 and 2 that both hands and fingers SQUEEZES support and drill beds TOGETHER and hands oscillate the attachment across the rim's FULL width.

P1

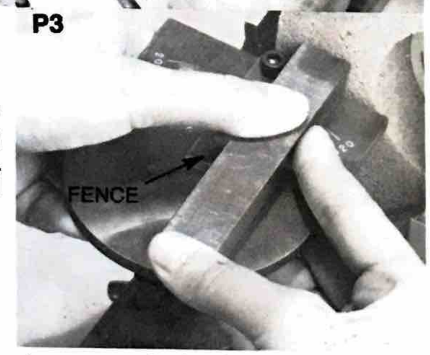


P2

P1—Left thumb is squeezing support and drill beds together and simultaneously pressing down on track bit. Right thumb is pressing tool against wheel and index finger presses shim against bed's vertical wall.

P2—Similar technique on spade bits but both index fingers are pressing on tool and both thumbs are pushing tool towards wheel.

P3



P3—Right thumb feeds workpiece to the wheel while index finger and left thumb keeps workpiece against the fence. Both hands work together with remaining fingers gripping table's under surface to sweep workpiece across rim's FULL width. **NOTE: Table's front end must be within 1/8" clearance with wheel and controls FIRMLY locked.**

HELPFUL HINTS

If a drill doesn't function, it's due to INSUFFICIENT lip clearance resulting from improper indexing; insufficient SECONDARY facet size on drills sharpened with low lip clearances or excessive grinding. Correct grinding begins in the area of the heels and soon as it moves forward to completely resurface the cutting edge, grinding MUST cease IMMEDIATELY. Further grinding REDUCES lip clearance accordingly. If excessive grinding occurs, the drill MUST be re-indexed and reground.

Inaccuracy results from failure to grind until screw tip engages lower bed; inadequate feed screw thread tension; drill not fully engaged in locater; UNEQUAL or distorted lands: bent drills, flute debris; failure to sweep BOTH drill faces equally across grinding rim's FULL width; inadequate tightening of lip relief, drill point angle or drill stop lock controls, or failure to raise-shift stop into contact with lower bed.

MOST IMPORTANT: With drills, especially large ones, increased heat build up and expansion in grinding the second face results in additional metal removal & inaccuracy. So, a coolant is a MUST.

SHORT bodied tapered shank drills tend to rock in the drill bed. This is prevented with short pieces of extruded aluminum angle, under shank's rear against the cube and taped to drill bed.

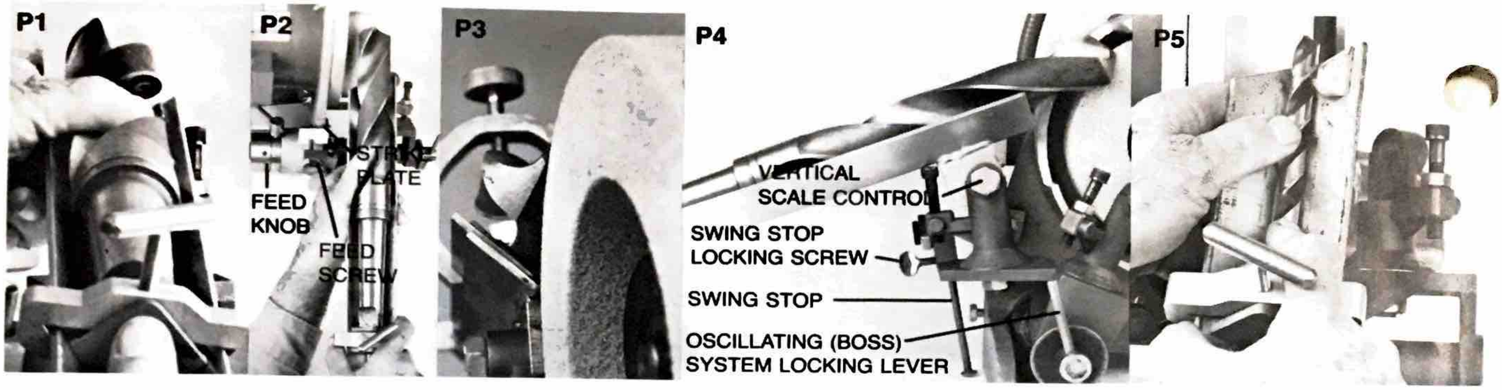
For offset point centers to prevent drill binding in deep soft metals, complete both drill faces and back off feed screw to grind slight additional amount off second face.

Do not remove the plastic washer on the feed screw mechanism. To retain its frictional properties, **AVOID LUBRICANTS** AND KEEP IT CLEAN with soap and water.

After wheel dressing, ALWAYS stone the wheel LIGHTLY with dressing stick. It OPENS the wheel and increases grinding action at least 200 percent. Diamond dressing is best for trueing the wheel, but also DULLS the wheel and drastically reduces grinding action.

Due to the machine's unlimited drill diameter range and ability to grind a wide range of tools and other metals, it is recommended to maintain fine and coarse grit wheels on hand for maximum customer satisfaction. For best results, use interchangeable diamond wheel for drills No. 60 through 1/8" diameter, 60 grit for 1/8" through 3/8", 46 grit for 3/8" through 3/4"; and 36 grit for drills above 3/4" diameter. For replacement wheels or operational assistance, be free to contact us at address below.

INSTRUCTIONS FOR GRINDING SPLIT POINTS, DUBBED DRILLS, PUNCHES & DIES



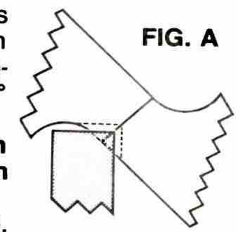


FIG. A

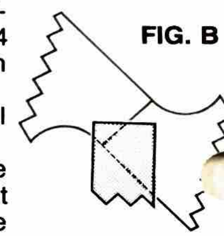


FIG. B

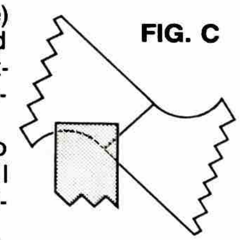


FIG. C

POINT SPLITTING STEP 1. With drill bed in position to wheel's right (P1), position drill so it's point is roughly flush with front end of the bed and flute edge is in contact with the locator. Then LEFT thumb presses drill's left flute lightly to torque drill against locater and RIGHT thumb applies steady forward pressure on cube until cutting edge spirals into the approximate 15° to 20° angle from the vertical as shown.

STEP 2. Rotate tool post to align desired number with the etched indicator. **NOTE: 90 thru 86 on the right half of the ring scale produces greater drilling efficiency accordingly and 90 thru 86 on the left side results in a little less drilling efficiency but more durable points accordingly.**

STEP 3. a. Adjust feed knob with left hand to put drill in P2 position (P3 is frontal view of p2). Right hand accomplishes P4 position (note drill bed's angle to the wheel) and then hold P4 position with LEFT hand while right hand LOCKS vertical scale control and oscillating system in P4 position. b. Bring feed screw tip into Strike Plate contact. c. Unlock swing stop and boss system to permit 1" to 1½" clearance between drill point and wheel and relock swing stop.

STEP 4. a. Energize motor. b. Adjust both feed controls SLIGHTLY for light exposure of the drill to the wheel. c. DUPLICATE hand grips of P2 or P5, in accordance with the drill's size.

(Note that left thumb presses the LEFT flute to torque drill against locater.) (Thumb pressure also restrains drill in the bed when drill's being notched). d. Press drill assembly lightly against the wheel until wheel sparks out. Then remove drill to examine notch's progress and compare the notch against the following figures. If the notch's apex is in alignment with the chisel's long (line) axis as shown in Fig. A, it indicates that both knob and feed screw settings are correctly adjusted and additional readjustment of BOTH controls will correctly advance the notch towards the dotted line "V" in fig. A. Once wheel sparks out at desired depth (feed screw tip & strike plate contact), grind opposite notch without disturbing the feed control settings.

Fig. B is the result of excessive Knob Feed setting. Drill point was moved too much laterally (to the left) into the wheel's rim. As a result, this notch has screwed up the cutting edge and drill must be repointed and then renotched. Excessive feed is avoided by repetitious LIGHT lateral adjustments and frequent inspections.

Fig. C shows excessive feed screw adjustment. However, this point is salvageable by completing the other side but first reduce the feed screw setting. The correct setting would have been to the dotted line. In short, make repetitious LIGHT re-adjustments of either or both controls as dictated to keep the notch's apex in alignment with chisel's long axis (Fig. A). For point splitting, there are no substitutes for skill and PRACTICE. The rewards are INCREASED safety and profits.

IMPORTANT NOTES. a. Minimum chisel length is .005" for small drills and .012" for large drills. b. As wheel loads up, FREQUENTLY and lightly stone both wheel's face and side rim with NORBIDE dressing stick. (Available from NORTON wheel suppliers). Use diamond dresser ONLY to restore wheel's balance and sharp corner: ALWAYS restone wheel after EVERY diamond dressing.

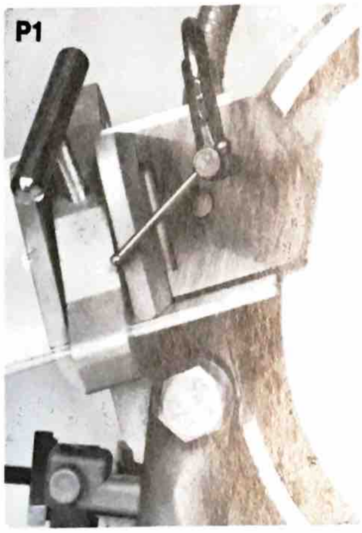
d. MOST IMPORTANT. If a heavy tapered shank causes the drill to rock, place a 1½" long x 5/16" thick piece of angle steel (shim) AGAINST the cube, UNDER the TANG.

DUBBED DRILLS utilize the same technique as point splitting but index the cutting edge into a 90 vertical angle, minus or plus 4°.

PUNCHES & DIES: a. First place a square block gage in the Punch & Die Bed and square the bed to the wheel, horizontally and vertically. The Anti-Shift Stop is used to fine tune vertical squaring and then press the bed against the shift stop when tightening the vertical control. b. Insert tool, apply clamp and rotate Feed Knob to bring tool up to the wheel but DO NOT, repeat!, DO NOT make contact with the wheel. c. Energize motor and SLOWLY rotate Feed Knob with left hand while right hand sweeps tool across full width of the grinding rim. IMPORTANT!! Don't sweep workpiece off the rim's full width until wheel sparks out.

IMPORTANT NOTE. A special wheel formulated by J & A Machinery is required for point splitting and dubbing. When re-ordering, specify part #19SPW or Point Splitting Wheel.

GRINDING THE TOP RAKE ON SPADE AND TRACK BITS



This operation requires the special SKEW POST part #SP-1, and specialized grinding wheel, part #19SPW, available from J & A Machinery.

Before grinding, familiarize yourself with certain functional parts shown on the previous page in P-2, P-4, and the parts list in the 6 page Instruction Manual.

STEP 1: First put a 3/16" radius on the wheel's outer corner, using a Norbide (Norton Products) dressing stick.

STEP 2: With Motor OFF, set up the spade bit as shown in P-1 and then use the spade bit as a gage by paralleling the bit's current top rake surface to the grinding rim's surface. (pivoting the Skew Post and spade bit clockwise produces more rake and less rake with CCW motion). With spade bit in P-1 position, lock the Oscillating (Boss) System and bring the Feed Screw's tip into CONTACT with the Strike Plate.

STEP 3: Now manipulate the FEED KNOB to BREAK contact (slightly) between the spade bit and wheel's grinding rim.

STEP 4: Energize motor and bring the tool back into a very brief and light wheel contact. (Oscillating System remains locked and feed screw tip in contact with the Strike Plate.) Then shut off motor, unlock the Oscillating System and draw spade bit assembly back from the wheel to check progress and make any necessary adjustments to assure that freshly reground new surface is parallel to the previously ground old surface.

STEP 5: With corrected adjustments, RELOCK the oscillating system (being sure there's screw tip and strike plate contact and manipulate the Feed Knob until desired amount of top rake is reground. **Note: Backing off screw tip from Strike Plate controls extension of top rake towards the tool's rear while increased manipulation of the Feed Knob increases the top rake's depth. Therefore, periodically check progress and adjust the controls accordingly.**

STEP 6: With top rake completed on the first side, unlock the oscillating system, (Feed screw and Feed knob settings remain undisturbed) rotate and reclamp tool to grind opposite top rake and press the bed assembly against the grinding wheel until wheel sparks out and screw tip contacts the strike plate. IMPORTANT! Be sure both sides of the tool is ground with the wheel sparking out and screw tip CONTACTING the strike place. For track bits, use same technique but clamp track bit shim between bit and bed wall.

WARNING: The maximum safe speed of standard 7" diameter type VI wheels is rated below the 3450 RPM speed of our motors. Consequently they are dangerous and it is strongly emphasized that you use ONLY J & A wheels which matches the speed of our motors.

When mounting diamond or borazon wheels on the machine, first place the wheel, spacer No. 17 (special order item) with recessed side (bearing surface side) facing you, then mount wheel and apply retaining flange directly in contact against wheel and tighten firmly.

CARE OF EQUIPMENT

LUBRICATION — Light grease on the Boss's shaft and grease fitting on Boss's swivel joint; dry lubricant, graphite spray paint on diamond holder (opposite side from threaded knurled head), INNER surfaces of lower carriage bed and powdered graphite on 9VSS. AVOID LUBRICANTS ON PLASTIC WASHER, ITS ADJACENT SURFACES, CONTACT AREA BETWEEN VERTICAL SCALE AND POST, AND DRILL STOP LOCK ASSEMBLY. Keep sliding surfaces free of abrasive particles with small paint brush, or compressed air.

The motor is permanently lubricated at the factory, and has a built-in thermal (heat switch) which automatically cuts off power to prevent excessive heat and damage. Therefore, if motor suddenly quits, allow it to cool off before restarting. However, if it shuts off repeatedly, have it checked. Motors carry a one year warranty from purchase date and your local branch of W.W. Grainger will service motor without charge, providing it's not altered.

The drill grinding mechanism is guaranteed for one year from date of purchase for any defective parts attributed to the company. However, we are not responsible for any damage of the equipment as a result of careless abuse. Nor will the J & A Machinery Company be held responsible or liable for any and all physical injuries that result from the operator's failure to adhere to this instruction manual's advice, and all other recommended safety practices. Since this instruction manual is furnished with each of our drill and tool grinders, it is the sole responsibility of any and all operators to read this instruction manual prior to operating the J & A Machinery Company's drill and tool grinding equipment.

PROUDLY MADE IN U.S.A. — J&A Machinery., 3136 Federal Ave., El Paso, Texas 79930 — 915/565-2868

Form 6 PIM 1-84