OPERATING INSTRUCTIONS AND SERVICE MANUAL

CINCINNATI

spiropoint drill sharpener

MODEL LM

SERIES 500 AND 750

CINCINNATI LATHE AND TOOL CO.

Cincinnati 9, Ohio U. S. A.

PUBLICATION SP-155

FOREWORD

This manual has been prepared for use with the Model LM Series 500 and 750 Spiropoint drill sharpeners manufactured by Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio, U.S.A.

Because of continual betterment of design, it is possible that data contained in this manual may not fully apply to the machine delivered to you. Any differences merely indicate that your machine incorporates improvements to better fulfill your requirements.

THE SPIROPOINT IS A PRECISION DRILL SHARPENER. FOR CORRECT OPERATION, IT IS ESSENTIAL THAT THE INSTRUCTIONS IN THIS MANUAL BE READ AND FOLLOWED.

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The Spiropoint Drill Sharpener

DESCRIPTION I-1

GENERAL . . . . . The Spiropoint Drill Sharpener is a precision drill grinder which automatically applies the "spiral point" to a standard twist drill. It is designed so that the drill is held in a stationary position. A tubular grinding wheel gyrates around the drill producing the desired shape on its point. The Spiropoint may be rapidly adjusted to grind a range of drill diameters, to produce clearance angles above or below the normal amount, and to produce point angles from 90 degrees to 180 degrees. The Spiropoint is a portable type unit supplied with cord plug-in connections for single phase, 50/60 cycle A.C. electrical operation.

MAJOR COMPONENTS

1. Clearance angle adjustment control.
2. Drill diameter adjustment control.
3. Work tray.
4. Flange type main drive motor.
5. Mist coolant system.
6. Individually motor driven dust collector.
7. Screw jacks.
8. Casters.
9. Adjustable precision truing device which shapes the grinding wheel surface so that the point angle of the drill may be varied from 90 degrees to 180 degrees.
10. Tubular grinding wheel mounted in a rotating spindle which gyrates around the drill axis producing the desired shape on the drill point.
11. Retractable radial locator for radially positioning the drill.
12. Drill clamping jaws activated by precision left and right-hand screws which equally advance both jaws, thereby centering the drill on the axis of wheel gyration.
13. Main slide on which the jaws are advanced or retracted to or from the grinding wheel.
14. Micrometer feed control. This control has a micrometer dial graduated in .001" which facilitates precise feed for stock removal.
15. Slide rapid advance and rapid retract lever.

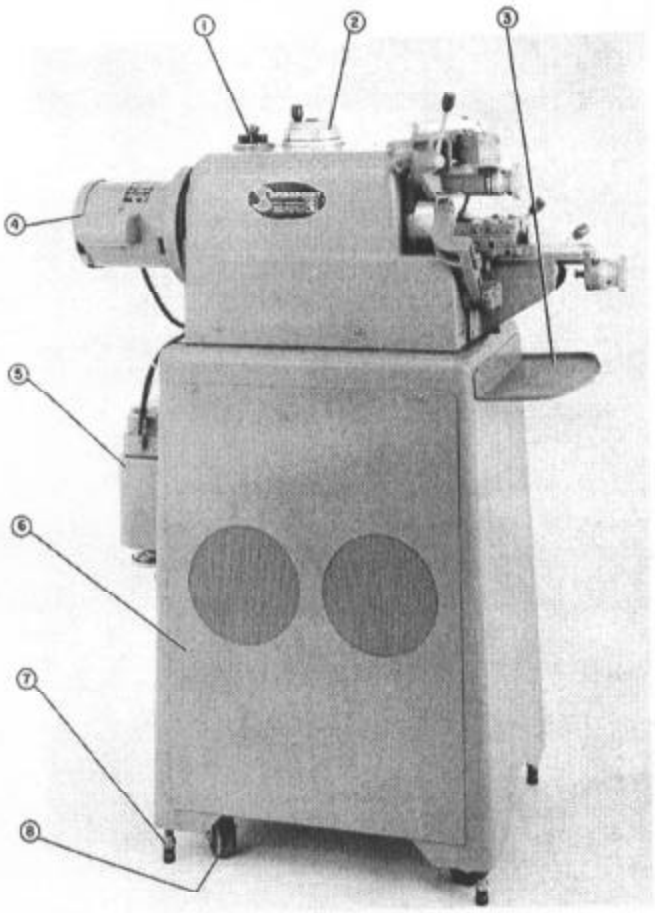


Figure 1.

16. Grinding wheel guard.

17. Spindle gyration stop control. This activates a solenoid and stop which accurately position the spindle for grinding wheel truing.

18. Jaw clamping lever.

19. On-off electrical switch.

20. Electrical panel and tool storage compartment.

21. Work light (not illustrated).

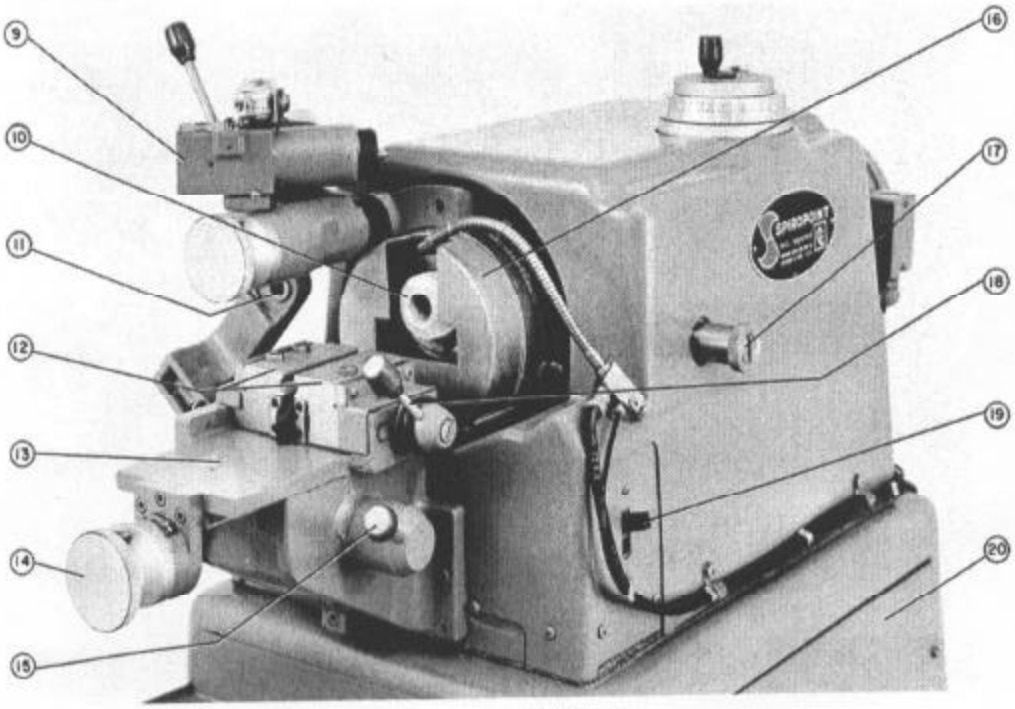


Figure 2.

OPERATING INSTRUCTIONS I-2

GRINDING DRILLS

1. Prior to sharpening drills, the Spiropoint should be turned on and allowed to warm up for 15 minutes.

2. The Spiropoint is adjusted for the specific drill diameter by setting the dial on top of the unit, graduated in 1/32" increments. A cone grind setting is included on the dial. This setting is employed for best results when truing the grinding wheel.

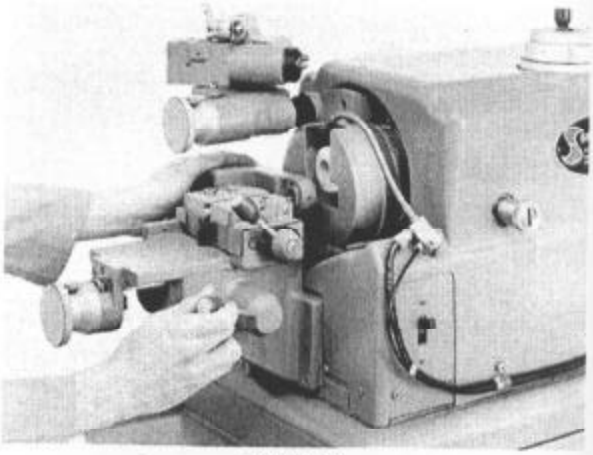


Figure 3.

3. Adjustment for clearance angles above or below the normal amount, as may be required for special applications, is provided by setting the second dial on top of the cabinet. See Section II-3, "Clearance Angles", for the correct settings for various angles.

4. To sharpen drills, retract the main slide with the rapid advance lever, swing the radial locator down to its positive stop, advance the slide as far as it will go, thereby locking the radial locator in its correct locating position. (See Figure 3.)

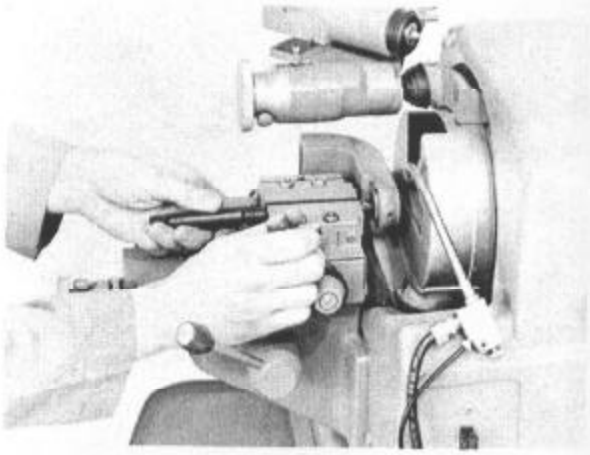


Figure 4.

5. Rotate the micrometer feed control counterclockwise as far as it will go.

6. Loosely clamp the drill between the vise jaws. Push the drill into the radial locator bushing and rotate it clockwise until the lips contact the locator stops. Lock the vise jaws with the clamping lever. (See Figure 4.)

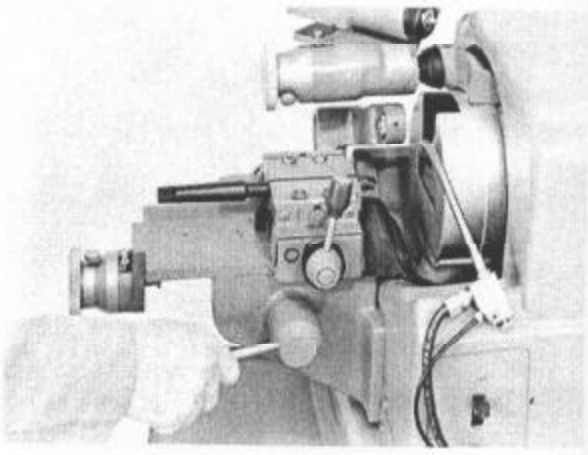


Figure 5.

7. Retract the slide with the rapid advance lever until the radial locator swings to its retracted position. (See Figure 5.)

8. Advance the slide with the rapid advance lever until the end of the travel is reached. (See Figure 6.)

9. Still exerting forward pressure on the rapid advance lever, feed the drill into the grinding wheel with the micrometer feed control. (See Figure 7.) The drill should be fed at a rate which will produce a bright finish without discoloration or over-heating. This will result in maximum drill life.

10. When the desired amount of stock has been ground from the drill, retract the slide, unclamp the vise jaws and remove the drill.

IF MORE THAN .015" to .020" OF STOCK IS REMOVED, ON COMPLETION OF THE GRIND, RELOCATE THE DRILL IN THE RADIAL LOCATOR BUSHING. THEN REMOVE APPROXIMATELY .003" to .005" MORE STOCK. THIS FINAL STEP IS USUALLY NECESSARY TO PRODUCE THE CORRECT POINT GEOMETRY. IT MUST ALWAYS BE PERFORMED WHEN GRINDING A "CHISEL POINT" TO A "SPIRAL POINT".

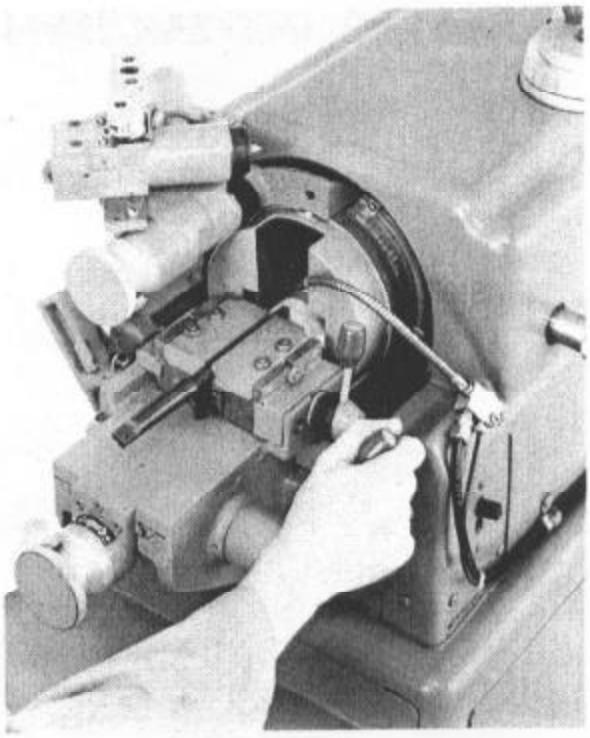


Figure 6.

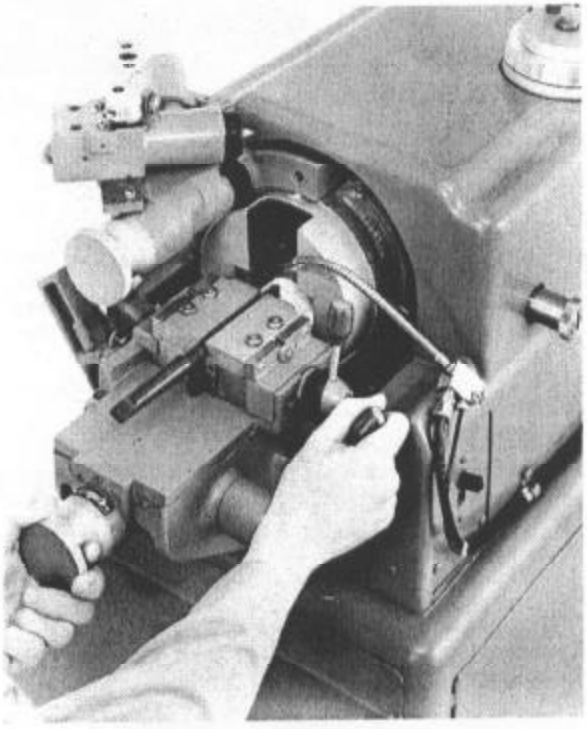


Figure 7.

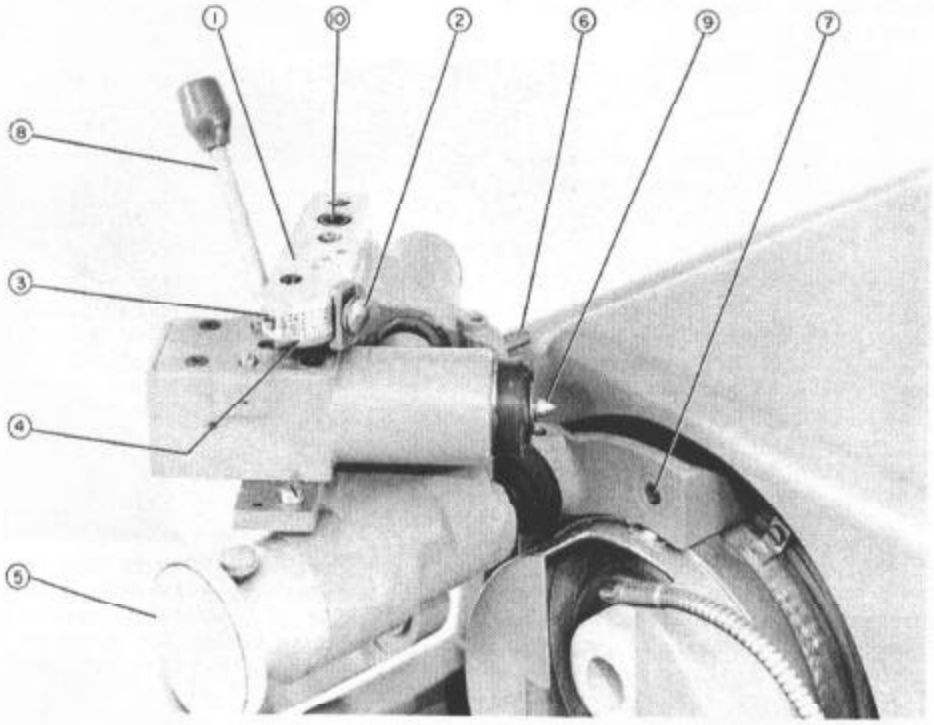


Figure 8.

GRINDING WHEEL TRUING

1. The Spiropoint is equipped with a precision truing device for the grinding wheel. It is adjustable so that the shape of the grinding wheel may be varied to produce a point angle from 90 degrees to 180 degrees.

2. To shape the grinding wheel for the desired point angle, adjust the cam (1, Figure 8) on the truing device. Loosen the lock nut (2). Rotate the adjusting screw (3) until the scribe line on the cam coincides with the scribe line for the desired point angle (4). (When employing the cam supplied with the small drill attachment, line up the heel of the cam with the scribe line for the desired point angle.) Retighten the lock nut.

3. For best truing results, set the drill diameter dial at cone grind.

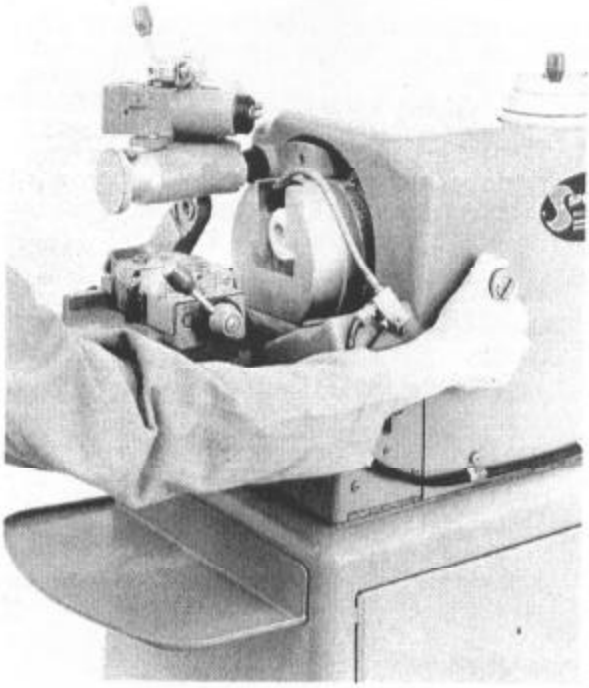


Figure 9.

4. Push in the spindle gyration stop control knob and turn it clockwise. This automatically stops spindle gyration. (See Figure 9.)

5. Retract the truing device until it may be swiveled clockwise by turning its micrometer feed control. (See Figures 10 and 11.) Advance the unit with the micrometer control so that the locating pin (6), Figure 8, seats in its mating hole (7). The micrometer control is then employed for movement of the diamond to and from the grinding wheel.

6. To dress the grinding wheel, swivel the dressing lever (8), Figure 8, so that the diamond travels along the face of the grinding wheel, up over its radius, and onto its outside diameter (see Figure 12). The radius and outside diameter of the grinding wheel are its most critical dimensions and should be very carefully dressed. The diamond should be passed over the grinding wheel at a moderate speed. A faster dress will result in a coarser finish on the grinding wheel, and eventually the drill. A slow dress will give a better finish on the grinding wheel, but this fine finish will have a tendency to burn the cutting edge of the drill.

7. The grinding wheel is dressed with a diamond nib (9), Figure 8, which should only be used for fine finish truing. It should be fed into the wheel no more than .001" per pass. When the radius of the grinding wheel is to be increased for larger size drills (see Section I-3, "Truing Cams"), it is recommended that this radius be dressed prior to dressing the entire grinding surface of the wheel. If the desired drill point angle requires a considerable amount of stock removal from the face of the grinding wheel, it is recommended that the initial stock removal be made with a coarse dressing stick. The truing device should then be employed for accurately finishing the grinding wheel. When using the dressing stick, be sure that no stock is removed from the outside diameter of the grinding wheel as this dimension is extremely critical.

8. After truing the grinding wheel, retract the truing unit until it may be swiveled counterclockwise. While swiveling the unit, rotate the micrometer control with the rotation of the truing unit.

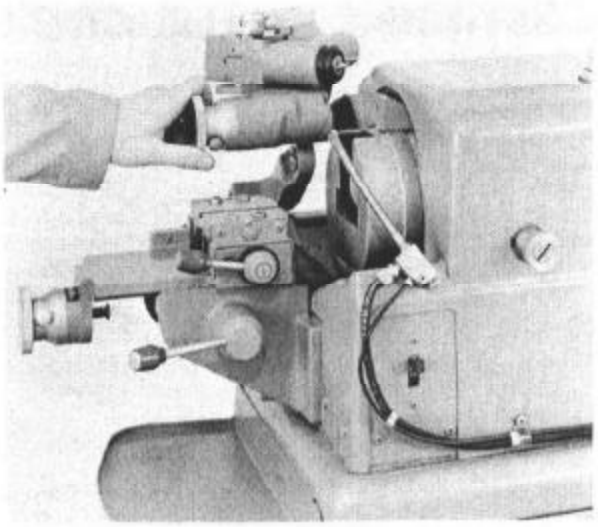


Figure 10.

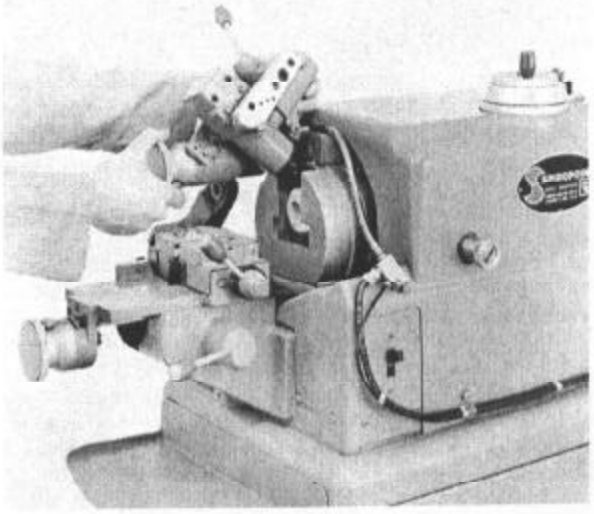


Figure 11.

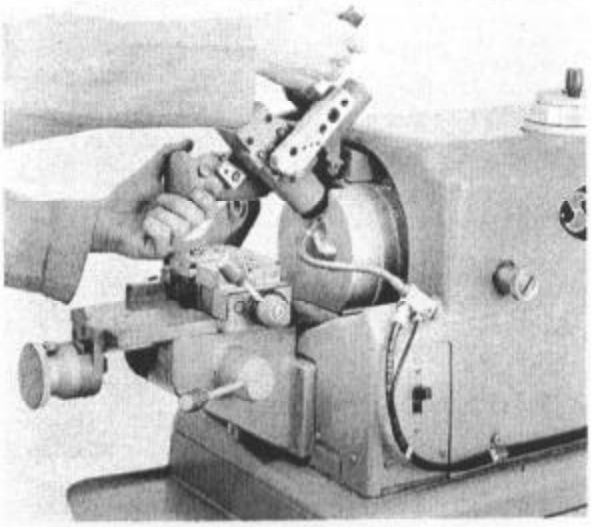
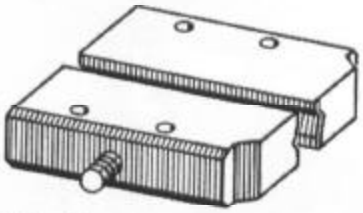


Figure 12.

ADDITIONAL OPERATING INSTRUCTIONS I-3

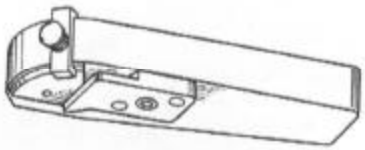


JAWS

Interchangeable vise jaws are supplied with the Spiropoint for various ranges of drill diameters. The Series 500 is equipped with one set of jaws for 1/8" to 1/4" drills, and one set of jaws for 1/4" to 1/2" drills. The Series 750 includes one set of jaws for 1/8" to 1/4" drills; one set for 1/4" to 1/2" and one set for 1/2" to 3/4". The small drill attachment has one set of jaws for #60 to 1/8" drills. Jaws are changed by removing the two nuts on top of the jaw and loosening the nut on its side with the wrench provided. When replacing jaws, be certain that no dirt is between the jaw and its support. A small amount of dirt will throw the jaws out of position.

RADIAL LOCATORS

The Series 500 is equipped with one radial locator for 1/8" to 1/2" drills. The Series 750 has one radial locator for 1/8" to 1/2" drills and one for 1/2" to 3/4" drills. The small drill attachment has one radial locator for #60 to 1/8" drills. To change radial locators, loosen the Allen screw at the end of the locator arm. The radial locator may then be removed from its socket. In replacing the radial locator, place it in its socket and line up the flat on the diameter of the radial locator with the scribe line on the locator arm. Retighten the Allen screw at the end of the locator arm.



TRUING CAMS

Interchangeable cams are provided for the truing attachment. A radius on the cam controls the radius of the grinding wheel. This radius must vary for ranges of drill diameters. The cams supplied, their radii, and the drill diameters for which they are used are as follows:

Drill Diameter Range	Cam Radius	Supplied with
5/8" to 3/4"	3/32"	Series 750
5/16" to 5/8"	1/16"	Series 500 and 750
1/8" to 5/16"	1/32"	Series 500 and 750
#60 to 1/8"	0	Small drill attachment

To change the cams, remove the Allen screw (10, see Figure 8) at the center of the cam. Withdraw the cam from its two locating pins. To replace the cam, retract the cam follower by applying light pressure to the diamond nib. Seat the cam on its locating pins and tighten the Allen screw. Every time the cam is changed, the grinding wheel must be trued and the diamond must be reset. See instructions below.

ADJUSTING THE DIAMOND

For accurate wheel truing, it is imperative that the diamond be correctly positioned in its holder. The diamond is locked by a set screw in a threaded bushing (see Figure 13). The bushing is, in turn, locked by a second set screw in the holder (see Figure 13.)

To position the diamond, loosen the set screw which locks the threaded bushing. Move the dressing lever until the cam follower has just passed over the radius of the cam. This position corresponds to the point at which the diamond has just passed from the radius onto the outside diameter of the grinding wheel (see Figure 14). Lock the cam follower in this position by tightening the thumb screw on the side of the diamond holder barrel. With the truing unit in its retracted position, mount the special diamond setting gage on the truing unit's locating pin (see Figure 14). Rotate the bushing with the special wrench provided until the diamond point just touches the ground radius on the arm of the diamond setting gage. It is recommended that the setting gage be swiveled slightly so that the operator can "feel" the diamond position. Retighten the set screw locking the threaded bushing. Loosen the thumb screw on the side of the diamond holder barrel.

In addition to positioning the diamond longitudinally, the rotation of the bushing repositions the diamond radially, thereby presenting a new surface for truing the grinding wheel and causing uniform diamond wear.

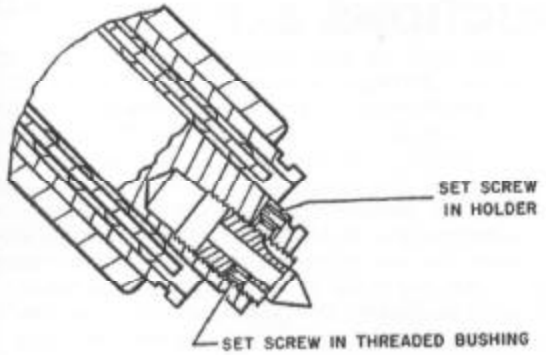


Figure 13.

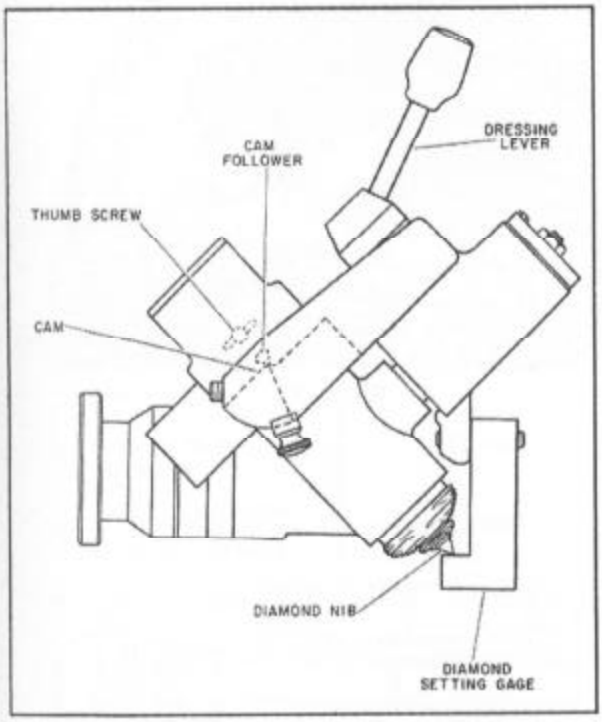
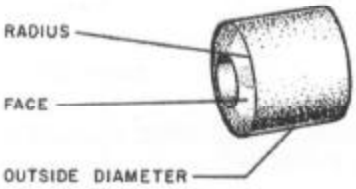


Figure 14.



GRINDING WHEELS

Selection of the proper grinding wheel depends on the size of drill that is to be sharpened. When smaller drills are ground, harder and finer grinding wheels are recommended. A coarse grit grinding wheel is recommended for larger diameter drills. The grinding wheels supplied as standard equipment with the Spiropoint have been selected to cover a range of drill sizes. Four grinding wheels are supplied as standard equipment with both the Series 500 and 750. Two of these grinding wheels are shaped for 118 degree points; two are shaped for 180 degree sheet metal points. Two grades of grinding wheels are provided in each shape. One grade is recommended for small drill diameters and one for large diameters. The small drill attachment includes an 118 degree grinding wheel and an 180 degree grinding wheel of a grade suited for the small drill range. In cases such as drill manufacturing and contract resharpening where it is possible to grind a large number of drills of one size at one time, it is recommended that a specific grade of grinding wheel be employed for a specific drill diameter. Consult the Products Division of The Cincinnati Milling Machine Co. for the correct wheel grade for these applications. Additional grinding wheels should be obtained from your grinding wheel supplier.

REPLACING GRINDING WHEELS
(See Figure 15, Grinding Wheel Guard Removed)

The tubular grinding wheel is mounted in a nylon collet in the spindle. To replace the grinding wheel, grip the spindle with the spanner wrench provided. Engage the face spanner wrench in the holes in the collar and rotate the collar counterclockwise. Loosen the collar until the grinding wheel may be removed.

To replace grinding wheels, seat the wheel in the collet. Tighten the collar. The grinding wheel should be located sufficiently deep in the collet so that the collet has ample bearing surface. It must project a sufficient amount to allow the diamond dresser to dress its outside diameter.

An adjustment bushing is provided in the spindle to allow in or out grinding wheel adjustment. Loosen the collar and position the adjustment bushing in or out with a screw driver. Once the grinding wheel is in the desired position, screw the bushing away from the wheel. The grinding wheel should not be seated on the bushing. The adjustment bushing is positioned on a pin. Be sure that the bushing is seated correctly on the pin. Do not start the machine with the grinding wheel removed as the adjustment bushing may be thrown from the spindle.

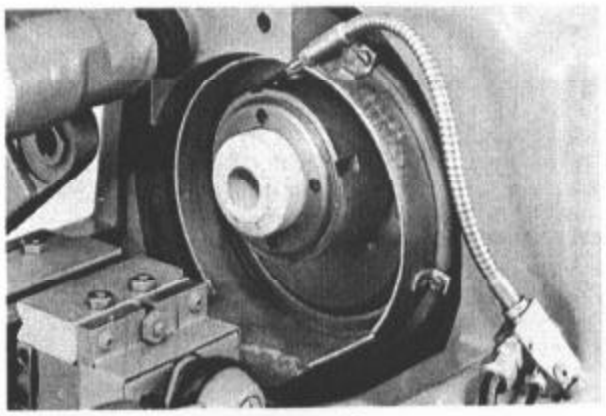


Figure 15.

ADDITIONAL OPERATING INSTRUCTIONS I-3

GRINDING WHEEL GUARD
(See Figure 2)

A removable grinding wheel guard is provided as standard equipment for the Spiropoint. This guard should always be employed during both grinding and truing operations. It not only is important for operator safety but also is essential for efficient functioning of the dust collector system.

The upper section of the grinding wheel guard must be removed when changing or adjusting the position of the grinding wheel. To remove this section of the guard, grasp it firmly and pull it toward the front of the machine.

ADJUSTING THE SLIDE GIB
(See Figure 16)

A taper gib is provided to compensate for wear between the bearing surfaces of the main slide. When wear develops in the slide, as indicated by loose movement, the gib should be tightened. This is accomplished as follows: Loosen the screw at the rear of the gib. Adjust the gib with the screw at its front. Then relock the gib with the screw at its rear. The gib should never be drawn up so tightly that it prohibits free movement of the slide with the rapid advance lever. NOTE: Tightening of the gib throws the jaws off center. To center the jaws, follow the instructions below.

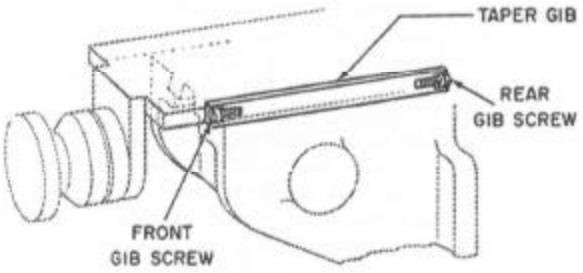


Figure 16.

CENTERING THE JAWS

To determine if the jaws are on center, perform the following steps. Set the drill diameter dial at cone grind. Mount the three diameter gage supplied with the machine in the jaws (see Figure 17). Mount a rod in the threaded hole (1/4-20 thread) in the face of the spindle housing. Mount a small dial indicator on the rod and place the indicator point on the largest diameter of the three diameter gage. Jog or rotate the spindle by hand so that the indicator point rotates around the diameter of the gage. The dial indicator will show any misalignment of the jaws.

To relocate the jaws, employ the threaded adjustment bushing on the right of the jaws (see Figure 18). Loosen the set screw on the underside of the casting. Then rotate the bushing clockwise or counterclockwise to correct the misalignment. Once the indicator shows the jaws are on center, retighten the set screw.

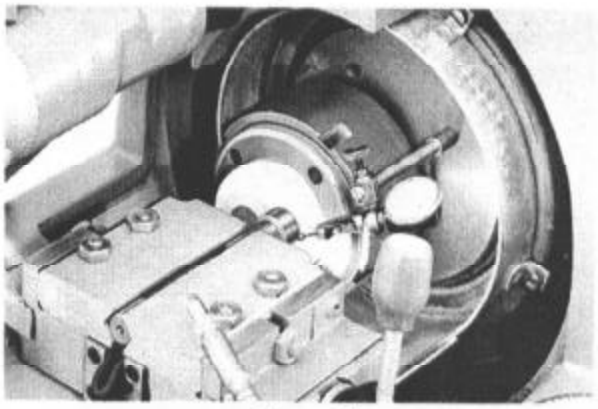


Figure 17.

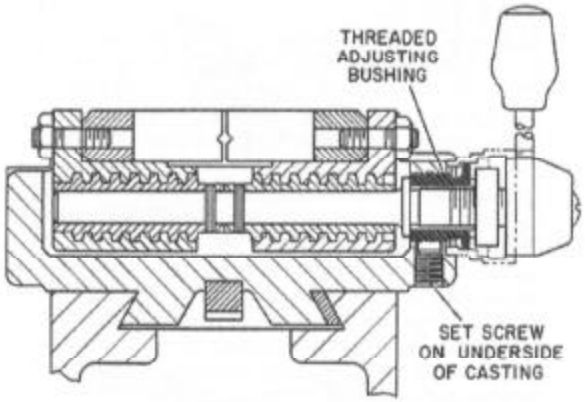


Figure 18.

CLEANING THE DUST COLLECTOR
(See Figure 1)

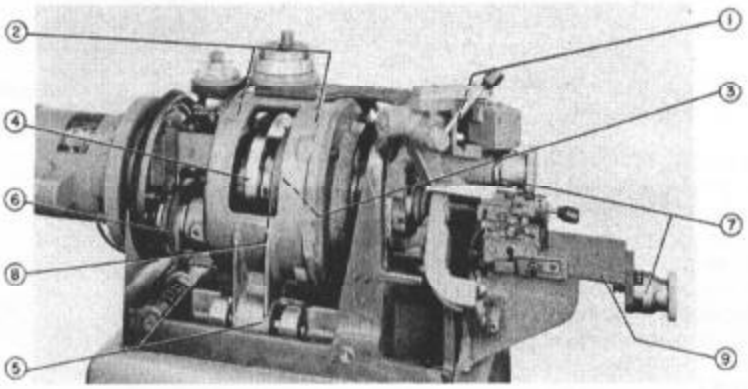
The dust collector must be emptied periodically depending upon the amount of usage. To empty it, remove the panel on the left side of the base. The dust bin is clamped by two latches to the bottom of the suction unit. Release the latches, drop the bin, and empty. A fiberglass filter is located on top of the dust bin. This should be periodically replaced or cleaned with forced air. When the mist coolant system is employed, clean the filter and bin weekly.

ELECTRICAL CORD

The Spiropoint is equipped with an eight foot electrical cord. If an extension is required, use 14 gage wire or heavier. Do not employ more than 25 feet of extension. If more than this is employed, a voltage drop may occur. A solenoid is employed in the Spiropoint. If there is more than 10% under or over voltage, the solenoid will malfunction. An extension cord longer than 25 feet may cause a voltage drop greater than 10%.

LUBRICATION

The Spriopoint has been fully lubricated at the factory prior to shipment. However, it is advisable to lubricate the components charted below when any internal repairs or component overhauls are performed. The main slide has an anti-friction treatment applied to its surface at the factory; therefore, it should not be further lubricated.



LUBRICATION POINTS		LUBRICANT	INSTRUCTIONS
1	Wheel dresser ball bearing	Grease*	Pack bearing cage with grease on inner and outer diameters
2	Housing roller bearings	Grease*	Pack with grease
3	Spindle ball bearings	Grease*	Pack with grease
4	Cam surfaces	Grease**	Wipe cam surfaces of large cam and pivot arm cams with grease
5	Housing and plate bearings	Grease*	Pack six bearing cages with grease on inner and outer diameters
6	Gears	Grease**	Grease teeth of all gears except those made of nylon
7	Dials (wheel dresser and work holder)	Grease*	Pack grease in cavities around dial screw
8	Roller followers	Grease*	Grease bearings in four roller followers
9	Work holder	Grease**	Grease rack and pinion. Do not lubricate the slide and dovetails

NOTE ON LUBRICANTS

* A light quality sodium or lithium short fiber grease such as ANDDOK M-275 made by Esso Standard Oil Co.

** A light quality special film lubricant such as Lubriplate 130-AA made by Fisk Brothers Refining Co.

COOLANT
(See Figure 1)

A mist coolant system is available on demand and is recommended. In addition to its normal use, during drill grinding, it is recommended that the mist be directed at the diamond point when truing the grinding wheel.

INSTALLATION INSTRUCTIONS I-4

UNCRATING INSTRUCTIONS

Upon receipt of shipment, carefully remove the crating and skids. Assemble the four casters and levelscrews to the base.

CLEANING THE SPIROPOINT

All finished metal parts have been coated with a film of slushing compound prior to shipment.

Do not move the work holding fixture slides or any other parts before the machine has been thoroughly cleaned. Use a good grease solvent to remove the slushing compound and dirt accumulated in transit. Wipe with rags rather than waste to eliminate lint. Do not use compressed air as this may force grit and dirt into important functioning units. Use a stiff bristle fibre brush to get into corners and to clean slides thoroughly.

LIFTING INSTRUCTIONS
(See Figures 19 and 20)

Four holes are provided in the cabinet to facilitate lifting the machine. Place "S" hooks in the holes or run pipes through them. DO NOT LIFT THE MACHINE BY PLACING A SLING UNDER THE MOTOR, WORK TRAY, OR WORK HOLDING BRACKET.

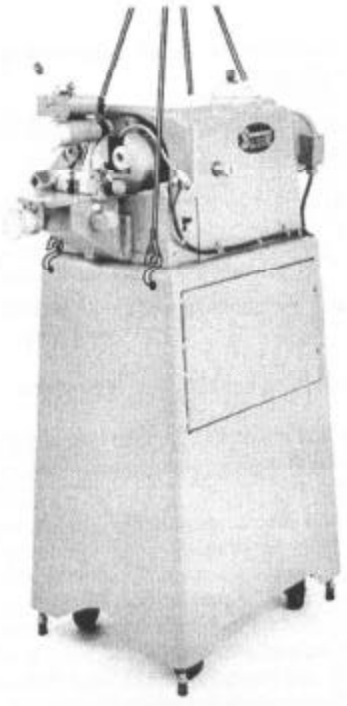


Figure 19.

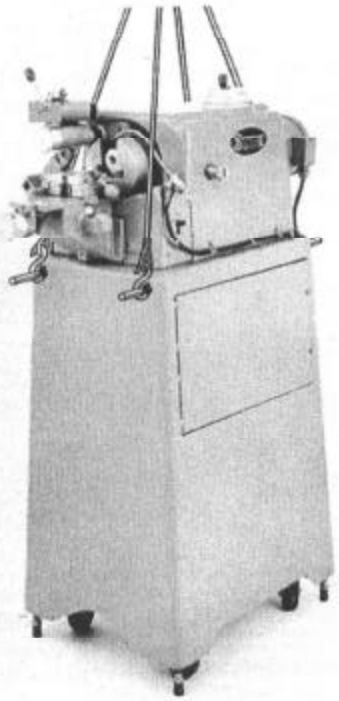


Figure 20.

PREPARATION FOR OPERATION

The main drive motor (see Figure 1) and the internal mechanism have been locked for shipment. Before operating the Spiropoint, remove the two wooden blocks under the main drive motor. These are fastened to the main casting by two screws. After removing the blocks, replace these screws with the two Allen head screws located in the fabric bag tied to the machine.

The main slide (see Figure 2) has also been locked for shipment. To unlock the slide, loosen the set screw located on the right side of the work holding bracket above and in front of the rapid advance lever (see Figure 2). Before moving the machine a considerable distance, relock the slide. Swing the radial locator arm to its locating position, advance the slide, thereby locking the radial locator arm in position, and tighten the slide lock set screw.

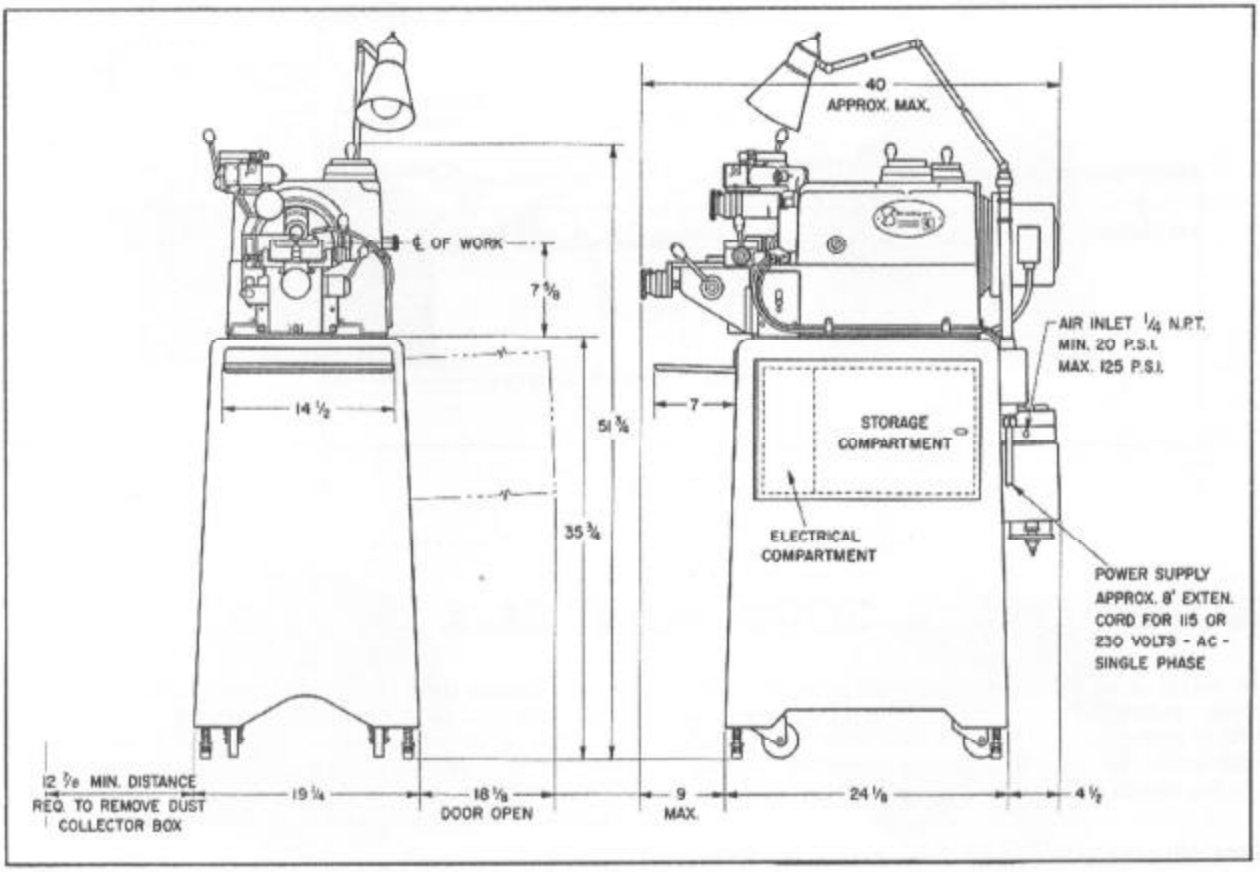
Mount the work tray (see Figure 1) by inserting its two brackets into the two lifting holes in the front of the base.

LEVELING INSTRUCTIONS

Although the Spiropoint is a precision drill sharpener, a precision level need not be maintained. Once the Spiropoint has been placed in its operating location, adjust the jack screws (see Figure 1) for stability of the unit.

SPECIFICATIONS I-5

CAPACITY	Drill diameter, inches -	Series 500	1/8" to 1/2"
		Series 750	1/8" to 3/4"
		Small drill attachment (extra cost)	#60 (.040") to 1/8"
	Number flutes		2
	Drill direction		Right hand
	Drill length min.	1/2" to 3/4" drill dia.	4-1/2"
		1/4" to 1/2" " "	4-1/4"
		1/8" to 1/4" " "	2-3/4"
		#60 to 1/8" " "	1-1/4"



STANDARD EQUIPMENT SUPPLIED WITH MACHINE

Complete electrical equipment including motor and controls for 115/230 volts, single phase, 60 cycle currect (50 cycle optional). Dust collector system with individually driven motor.

Grinding wheel truing attachment including one diamond and a diamond setting gage.

Grinding wheel truing cams.

Jaws

Locators

Necessary wrenches

Two grinding wheels shaped for 118 degree drills and two grinding wheels shaped for 180 degree drills.

Work tray

OPTIONAL EQUIPMENT SUPPLIED AT EXTRA COST

Small drill attachment - #60 (.040") to 1/8" capacity including locator, jaws, cam, and two grinding wheels.

Adjustable light, mounted, complete

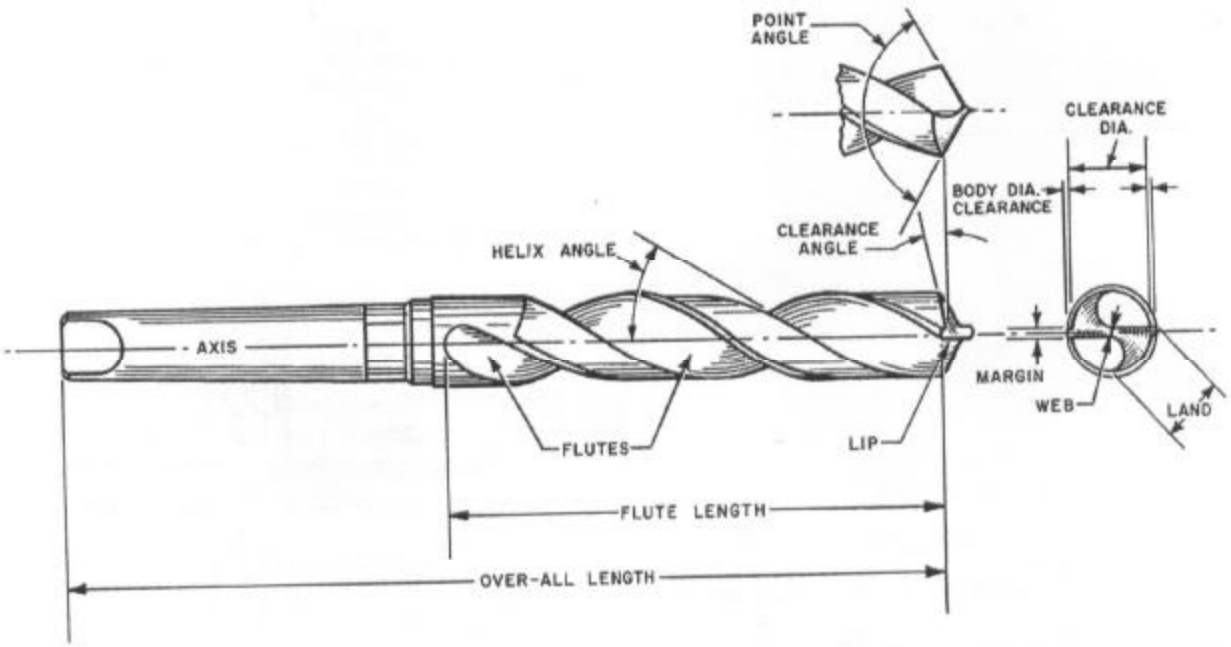
Extra diamond nib

Mist coolant system

Special jaws

DRILL NOMENCLATURE II-1

To assist in the identification of drill elements discussed hereafter, refer to the drill nomenclature chart below.



RECOGNIZING A GOOD POINT II-2

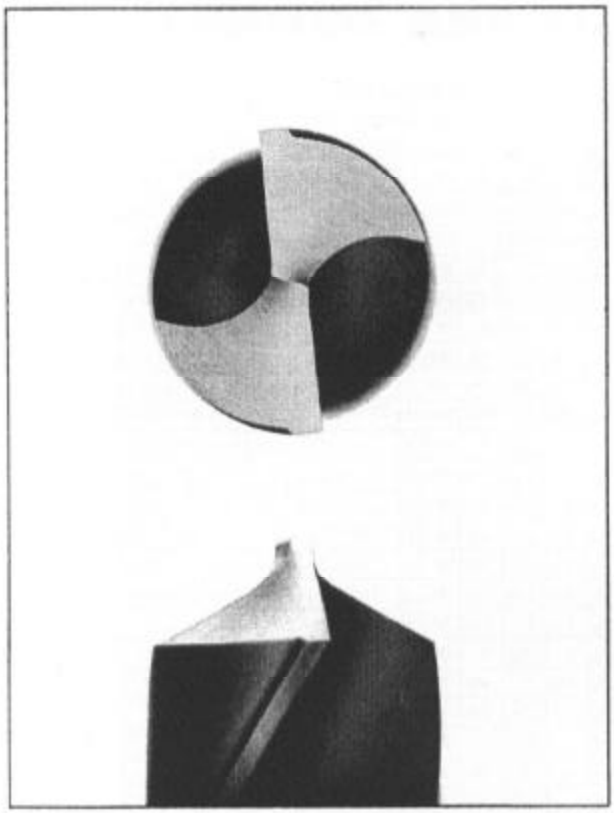
The spiral point is a precision drill point for precision drilling. It is critical, therefore, that the precise geometry built into the Spiropoint be applied to the drill. Deviations from this geometry will reduce the effectiveness of the spiral point.

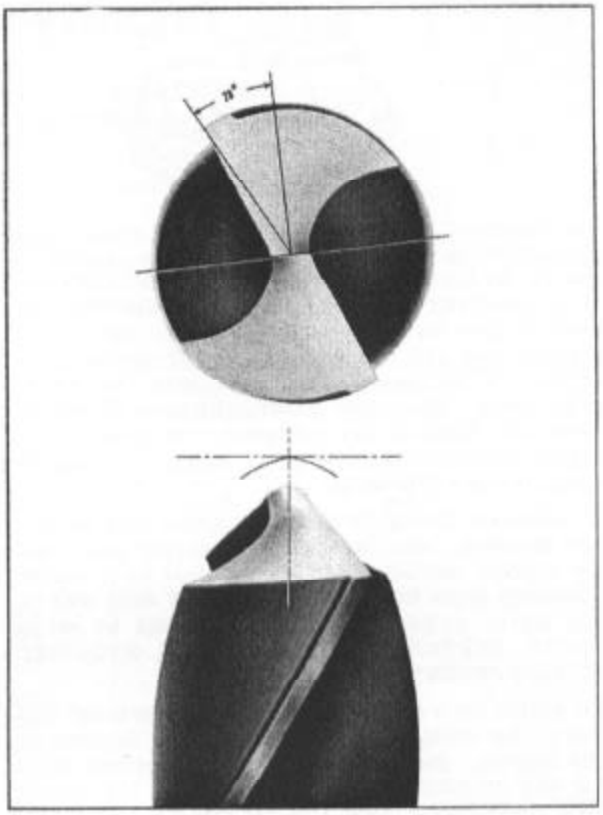
There are several critical adjustments on the Spiropoint which, if incorrectly made, will result in inferior point geometry. By examining the drill point produced by the Spiropoint, it is possible to quickly determine whether or not all adjustments have been properly made on the machine.

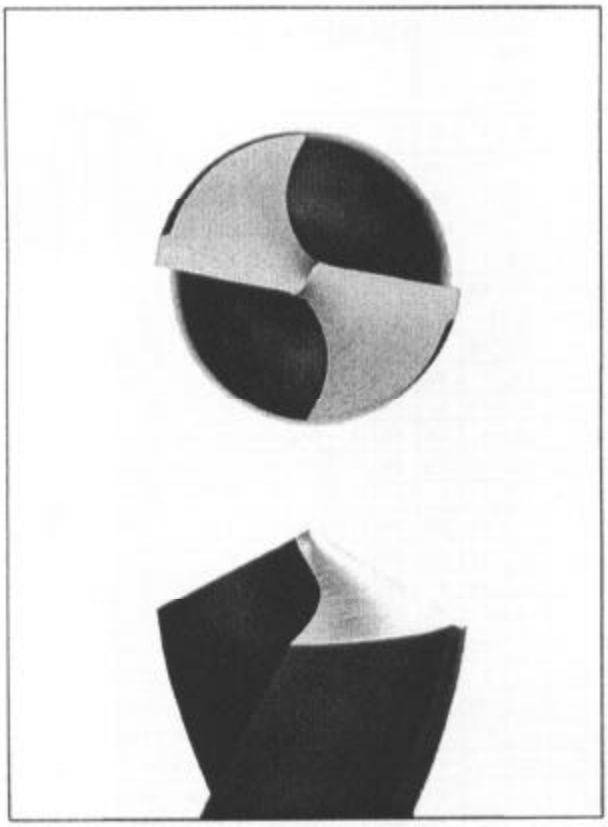
A drill with an 118 degree point angle and a perfect spiral point is illustrated on the facing page. The side elevation shows the spiral point of the drill to consist of two gently sloping arcs terminating at the axis of the drill. Both ends of the arcs should be of equal height. These arcs are generated by the radius of the grinding wheel. If the point of the drill is straight, the radius of the grinding wheel is undersize. Should the point appear too rounded and too long, the radius of the grinding wheel is oversize. If either of these conditions develops, make certain that the correct cam for the truing unit is being used. If the correct cam is in use, then the difficulty is caused by incorrect positioning of the diamond nib.

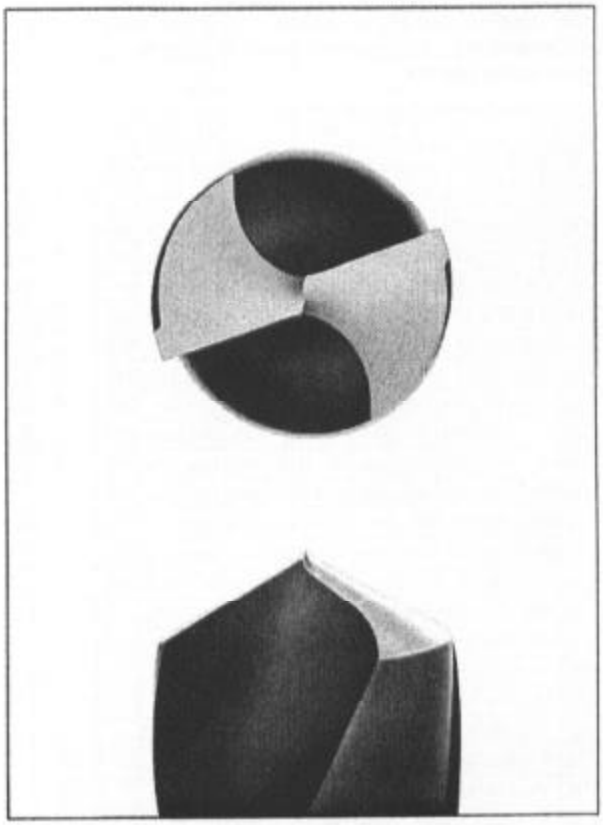
With the drill axis parallel to the line of vision, the spiral point shows the characteristic S shape formed by the intersection of two arcs which tend to blend into the primary cutting edge. A line drawn perpendicular to the tangent to the arcs should form approximately a 28 degree angle to a line drawn from the axis of the drill to the tip of the primary cutting edge.

If this angle is considerably less than 28 degrees, the outside diameter of the grinding wheel is undersize. If the angle is considerably greater than 28 degrees, the outside diameter of the grinding wheel is oversize. Both conditions are caused by incorrect positioning of the diamond nib in the truing unit.

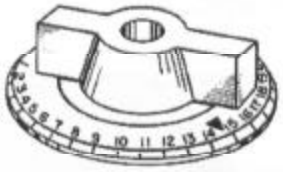



75°





CLEARANCE ANGLE II-3



The clearance control knob is graduated in reference numbers from 1 to 35. Between reference number 14 and 15, an arrow is scribed. The arrow is scribed at the point which Cincinnati Lathe and Tool Co. has found to give the best clearance angles for general purpose use with 118 degree and 180 degree point angles. In the case of a 1/2" drill with 118 degree point angle, the arrow position gives a 10 degree clearance angle at the periphery. It gives an 11 degree clearance to a 1/4" drill, and a 9-1/2 degree clearance to a 3/4" drill.

If values of clearance above or below this normal are required, refer to the accompanying charts for the correct setting. For example, if an 8 degree clearance angle is required for a 1/4" drill with an 118 degree point angle, the dial should be set at 10-3/4. DIFFERENT SETTINGS ARE REQUIRED FOR DIFFERENT POINT ANGLES.

To obtain the recommended "general purpose" dial setting for point angles other than 118 degrees or 180 degrees, find the recommended clearance angle for the specific drill diameter on the 118 degree point angle chart. Then find the dial setting for this clearance angle on the applicable point angle chart.

Settings for 90 degree, 118 degree, and 135 degree point angles are given below. If other point angles are employed, the correct setting may be estimated from these charts.

DRILL DIA.	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
1/16	10¾	11	11¼	11½	11¾	12¼	12½	12¾	13	13¼	13⅜
3/32	10	10½	11	11¼	11¾	12¼	12¾	13¼	13¾	14¼	14¾
1/8	9¼	10	10¾	11⅛	11¾	12½	13	13¾	14¼	15	15¾
5/32	8¾	9½	10¼	11	11¾	12¾	13½	14¼	15	15¾	16½
3/16	8¼	9¼	10	11	11¾	12¾	13¾	14¾	15¾	16½	17½
7/32	7¾	8¾	9¾	10¾	12	13	14	15¼	16¼	17½	18½
1/4	7¼	8¼	9½	10¾	12	13⅛	14½	15⅜	17	18⅛	19½
9/32	6½	8	9¼	10¾	12	13¼	14¾	16⅛	17½	19	20½
5/16	6	7½	9	10½	12	13½	15	16½	18¼	19¾	21¼
11/32	5½	7	9¼	10¼	12	13¾	15¼	17	18¾	20½	22¼
3/8	5	6½	8½	10¼	12	13¾	15½	17½	19½	21¼	23¼
13/32	4½	6	8¼	10	12	14	16	18	20	22¼	24¼
7/16	3¾	5¾	7¾	10	12	14⅛	16¼	18½	20¾	23	25⅛
15/32	3¼	5¼	7½	9¾	12	14⅛	16¾	19	21¼	23¾	26¼
1/2	2¾	5	7¼	9¾	12	14½	17	19½	22	24¼	27
17/32	2	4½	7	9½	12	14¾	17¼	20	22¾	25¼	28
9/16	1½	4	6¾	9½	12	15	17¾	20½	23¼	26¼	29
19/32	1	3¾	6½	9¼	12	15	18	21	24	27	30
5/8	...	3¼	6	9¼	12	15¼	18¼	21½	24½	27¾	31
21/32	...	3	5¾	9	12	15½	18½	22	25¼	28½	32
11/16	...	2½	5½	8¾	12	15½	19	22¼	25¾	29¼	32¾
23/32	...	2	5¼	8¾	12	15¾	19¼	22¾	26½	30⅛	33¾
3/4	...	1½	5	8½	12	15¾	19½	23¼	27	31	34¾

Series 500

Series 750

118° Point Angle

DRILL DIA.	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
1/16	12½	12¾	13	13¼	13½	14	14¼	14½	14¾	15¼	15½
3/32	12¼	12¾	13¼	13½	14	14½	15	15½	16	16½	17
1/8	12¼	12¾	13¼	14	14½	15	15¾	16¼	17	17½	18¼
5/32	12	12¾	13½	14¼	15	15¾	16½	17¼	18	18¾	19¾
3/16	11¾	12¾	13½	14½	15½	16¼	17¼	18¼	19¼	20	21
7/32	11¾	12¾	13¾	14¾	16	17	18	19	20¼	21¼	22½
1/4	11½	12¾	14	15	16¼	17½	18¾	20	21¼	22½	23¾
9/32	11½	12¾	14	15½	16¾	18¼	19½	21	22¼	23¾	24¾
5/16	11¼	12¾	14¼	15¾	17¼	18¾	20¼	22	23½	25	26½
11/32	11	12¾	14¼	16	17¾	19½	21	22¾	24½	26¼	28
3/8	11	12¾	14½	16¼	18¼	20	21¾	23¾	25½	27½	29½
13/32	10¾	12¾	14¾	16¾	18½	20½	22½	24¾	26¾	28¾	30¾
7/16	10½	12¾	14¾	17	19	21¼	23¼	25½	27¾	30	32¼
15/32	10½	12¾	15	17¼	19½	21¾	24¼	26½	28¾	31¼	33½
1/2	10¼	12¾	15	17½	20	22½	25	27½	30	32½	34¾
17/32	10¼	12¾	15¼	17¾	20½	23	25¾	28¼	31	33¼	....
9/16	10	12¾	15½	18¼	20¾	23¾	26½	29¼	32	35	....
19/32	9¾	12¾	15½	18½	21¼	24¼	27½	30¼	33¼	....	....
5/8	9¾	12¾	15¾	18¾	21¾	24¾	28	31	34¼	....	....
21/32	9½	12¾	15¾	19	22	25¼	28½	31¼	....	....	....
11/16	9¼	12¾	16	19¼	22¼	26	29½	33	....	....	....
23/32	9¼	12¾	16¼	19¾	23¼	26¾	30¼	33¾	....	....	....
3/4	9	12¾	16¼	20	23½	27¼	31	34½	....	....	....

Series 500

Series 750

90° Point Angle

DRILL DIA.	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
1/16	9¼	10	10¼	10¾	11	11½	11¾	12	12¼	12½	13
3/32	9	9½	10	10¼	10¾	11¼	11¾	12¼	12¾	13¼	13¾
1/8	8¼	9	9½	10	10¾	11¼	12	12½	13	13¾	14½
5/32	7½	8¼	9	9¾	10½	11¼	12	12¾	13½	14¼	15
3/16	6¾	7½	8½	9¼	10¼	11¼	12	13	14	15	15¾
7/32	5¾	6¾	8	9	10	11¼	12¼	13¼	14½	15½	16½
1/4	5	6¼	7½	8¾	10	11¼	12½	13½	14¾	16	17½
9/32	4½	5¾	7	8¼	9¾	11	12½	14	15¼	16¾	18¼
5/16	3¾	5	6½	8	9½	11	12½	14	15¾	17¼	19
11/32	3	4½	6	7¾	9¼	11	12¾	14½	16¼	18	19¾
3/8	1¾	3¾	5½	7½	9¼	11	12¾	14¾	16½	18½	20½
13/32	1¼	3	5	7	9	11	13	15	17	19	21¼
7/16	...	3	4½	6¾	8¾	11	13¼	15¼	17¼	19¾	22
15/32	...	2	4	6¼	8½	11	13¼	15½	18	20¼	22¾
1/2	...	1	3½	6	8½	10¾	13¼	15¾	18¼	20¾	23¼
17/32	...	...	3	5¾	8¼	10¾	13¼	16	18¾	21½	24
9/16	...	...	2½	5¼	8	10¾	13½	16¼	19¼	22	24¾
19/32	...	...	2	5	7¾	10¾	13¾	16½	19½	22½	25½
5/8	...	...	1½	4½	7½	10¾	13¾	17	20	23¼	26¼
21/32	...	...	1	4¼	7½	10¾	14	17¼	20½	23¾	27¼
11/16	...	...	...	4	7¼	10¾	14	17½	20¾	24¼	28
23/32	...	...	...	3½	7	10½	14¼	17¾	21¼	25	28¾
3/4	...	...	...	3¼	6¾	10½	14¼	18	21¾	25½	29½

Series 500

Series 750

135° Point Angle

WEB THICKNESS AND CONCENTRICITY II-4

Correct web thickness and web concentricity are essential for best results with spiral point drills. Standard web thicknesses for standard drills are shown in the table below.

The webs of heavy web drills or drills which have been sharpened many times will usually exceed the standard thickness. For best drill performance, thin the webs of these drills to the indicated standard.

If the point of a spiral pointed drill appears to be off center, the web of the drill is off center. The web should be centered by grinding one flute.

DRILL DIAMETER	WEB THICKNESS	DRILL DIAMETER	WEB THICKNESS	DRILL DIAMETER	WEB THICKNESS
.0400	.011	.1406	.029	.3125	.052
.0410	.011	.1440	.029	.3160	.052
.0430	.012	.1470	.029	.3230	.052
.0453	.012			.3281	.053
.0469	.012	.1520	.030		
.0492	.013	.1562	.031	.3320	.054
.0512	.013			.3390	.055
.0531	.013	.1610	.032	.3438	.055
.0550	.014	.1660	.033	.3480	.056
.0571	.014	.1695	.033		
.0591	.014	.1719	.034	.3543	.056
.0610	.015	.1730	.034	.3594	.057
.0625	.015	.1770	.034	.3680	.058
.0630	.015	.1800	.036	.3750	.059
.0650	.015	.1850	.036	.3860	.060
.0670	.016	.1875	.036	.3906	.060
.0700	.016	.1910	.036	.3970	.062
.0730	.017	.1935	.036		
.0760	.017	.1960	.036	.4062	.062
.0781	.017	.1990	.036	.4219	.063
.0810	.018	.2031	.036	.4375	.065
.0827	.018	.2090	.037	.4531	.068
.0860	.019	.2130	.037	.4688	.071
.0890	.019	.2188	.037	.4844	.072
.0906	.020	.2244	.038	.5000	.075
.0938	.020	.2280	.038	.5156	.076
.0960	.020	.2344	.039	.5312	.078
.0995	.021	.2402	.041	.5469	.079
.1024	.021	.2460	.042	.5625	.082
.1040	.022	.2500	.042	.5781	.084
.1065	.022	.2520	.042	.5938	.084
.1094	.023	.2570	.043	.6094	.086
.1130	.023	.2610	.044	.6250	.090
.1160	.024	.2656	.044	.6406	.090
.1200	.024	.2720	.045	.6562	.091
.1220	.025	.2770	.047	.6719	.094
.1250	.025	.2812	.047	.6875	.095
.1285	.026	.2854	.047	.7031	.095
.1299	.027	.2913	.048	.7188	.096
.1339	.027	.2969	.048	.7344	.100
.1360	.028	.3020	.050	.7500	.102
.1378	.028	.3071	.051		

TOLERANCES

DRILL DIAMETER	LIMITS
Up to 1/16", incl.	Plus or Minus .0025
Over 1/16" to 1/8", incl.	Plus or Minus .0030
Over 1/8" to 1/2", incl.	Plus or Minus .0050
Over 1/2" to 3/4", incl.	Plus or Minus .0080

LETTER AND NUMBER DRILL CONVERSION CHART II-5

FRACTION	NUMBER	LETTER	DECIMAL
1/32			.0312
	60		.0400
	59		.0410
	58		.0420
	57		.0430
	56		.0465
3/64			.0469
	55		.0520
	54		.0550
	53		.0595
1/16			.0625
	52		.0635
	51		.0670
	50		.0700
	49		.0730
	48		.0760
5/64			.0781
	47		.0785
	46		.0810
	45		.0820
	44		.0860
	43		.0890
	42		.0935
3/32			.0937
	41		.0960
	40		.0980
	39		.0995
	38		.1015
	37		.1040
	36		.1065
7/64			.1093
	35		.1100
	34		.1110
	33		.1130
	32		.1160
	31		.1200
1/8			.1250
	30		.1285
	29		.1360
	28		.1405
9/64			.1406
	27		.1440
	26		.1470
	25		.1495
	24		.1520
	23		.1540
5/32			.1562
	22		.1570
	21		.1590
	20		.1610
	19		.1660
	18		.1695
11/64			.1719
	17		.1730
	16		.1770
	15		.1800
	14		.1820
	13		.1850
3/16			.1875
	12		.1890
	11		.1910
	10		.1935
	9		.1960
	8		.1990
	7		.2010
13/64			.2031
	6		.2040
	5		.2055
	4		.2090
	3		.2130
7/32			.2187
	2		.2210
	1		.2280
		A	.2340
15/64			.2344
		B	.2380
		C	.2420
		D	.2460
1/4			.2500
		F	.2570
		G	.2610
17/64			.2656
		H	.2660
		I	.2720
		J	.2770
		K	.2810
9/32			.2812
		L	.2900
		M	.2950
19/64			.2968
		N	.3020
5/16			.3125
		O	.3160
		P	.3230
21/64			.3281
		Q	.3320
		R	.3390
11/32			.3437
		S	.3480
		T	.3580
23/64			.3594
		U	.3680
3/8			.3750
		V	.3770
		W	.3860
25/64			.3906
		X	.3970
		Y	.4040
13/32			.4062
		Z	.4130
27/64			.4219
7/16			.4375
29/64			.4531
15/32			.4687
31/64			.4844
1/2			.5000
33/64			.5156
17/32			.5312
35/64			.5469
9/16			.5625
37/64			.5781
19/32			.5937
39/64			.6094
5/8			.6250
41/64			.6406
21/32			.6562
43/64			.6719
11/16			.6875
45/64			.7031
23/32			.7187
47/64			.7344
3/4			.7500

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Litho in U.S.A.