

OPERATING MANUAL

FOR

MODEL CG-21 AND CG-2

UNIVERSAL

CUTTER GRINDER

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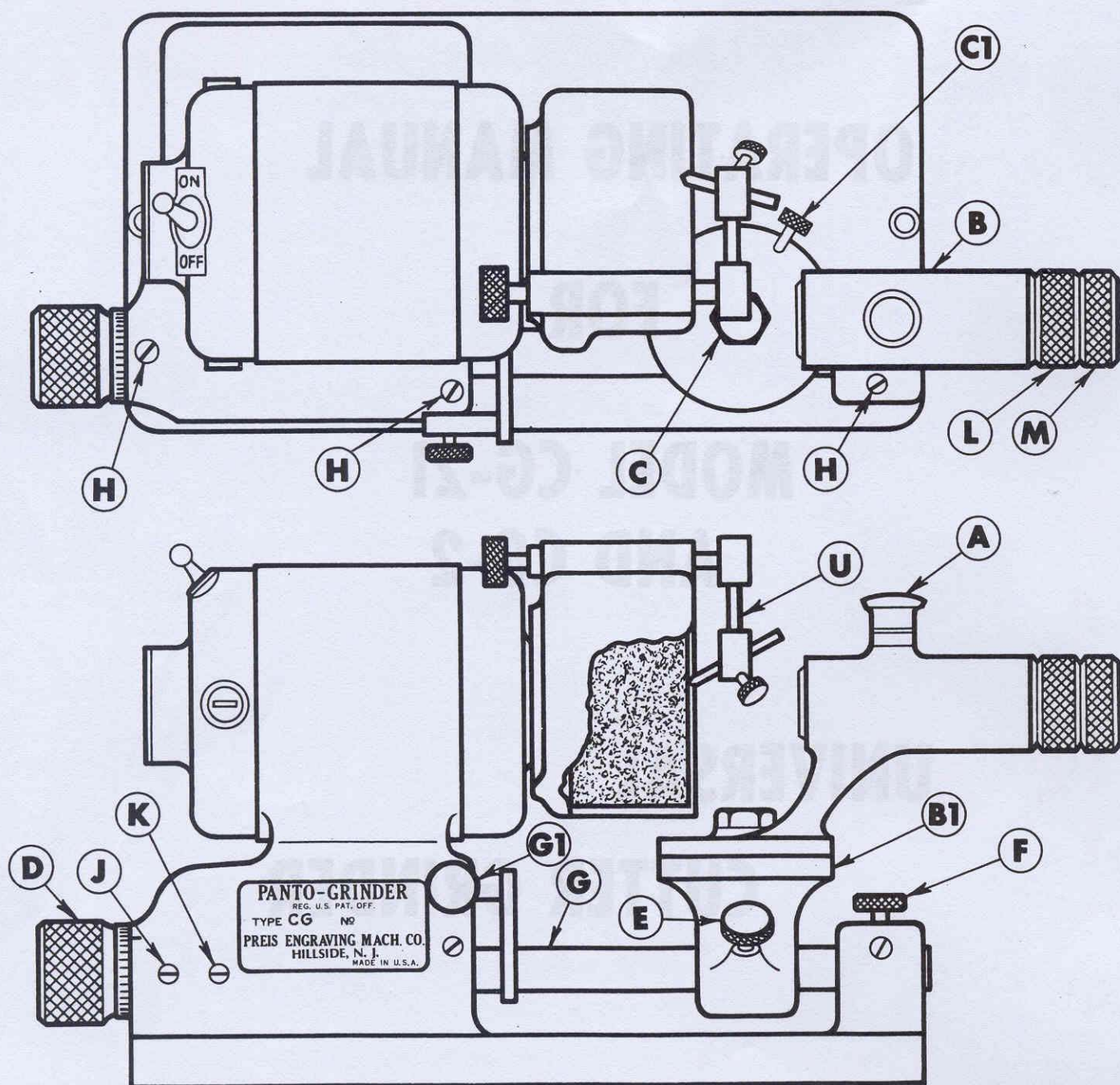
TRADE MARK

651 U. S. HIGHWAY 22

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"Since 1923 the Finest Engraving Equipment"



DESIGNATION OF PARTS

PART NO.		PART NO.	
122-A	A - Spindle Index Unit	120-1	G - Swivel Shaft
121-1	B - Swivel Arm	915-1-2	G1 - Adjustable Stop Screw
122	B1 - Swivel Bracket	123-5	H - Oil Holes
ESN-5/16-24	C - Swivel Arm Adjusting Nut	123-4	J - Collar Retainer Screw
10-32 x 3/8	C1 - Swivel Arm Lock Screw	123-3	K - Swivel Shaft Limit Screw
123-1	D - Feed Screw Collar	119C-2	L - Spindle Adjusting Collar
10-32 x 3/8	E - Swivel Bracket Lock Screw	119-2	M - Collet Arbor
10-32 x 3/8	F - Swivel Shaft Lock Screw	1061	U - Overhead Diamond Dresser Attachment

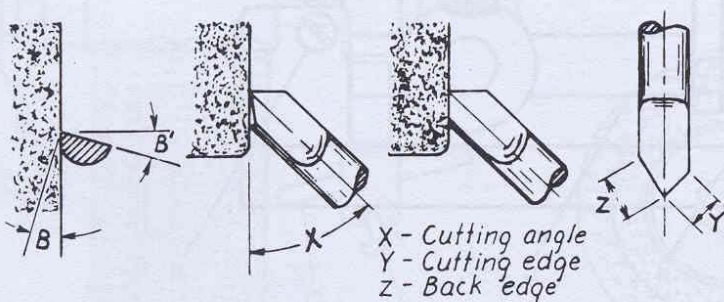
The grinding spindle of the Model CG-2 CUTTER GRINDER is provided with notches for grinding half-round (180°), quarter-round (90°), three-cornered, or four-cornered cutters.

Taper shank cutters are furnished in half-round or quarter-round made of high speed steel. Taper shank half-round in tungsten carbide. Straight shank cutters are furnished in half-round or quarter-round in high speed steel and tungsten carbide. Straight cutters half-round are available in a super high speed cobalt steel. (SEE 103-B BROCHURE FOR COMPLETE RANGE OF SIZES). All cutters are ground exactly to center and only require grinding of the proper cutting angle and clearance.

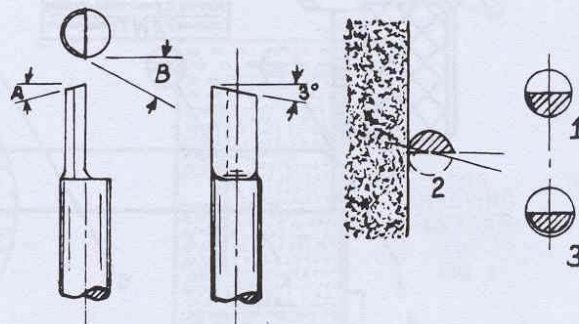
Model CG-2 Cutter Grinder is ideally suited for sharpening (1) cylindrical cutters, (2) conical pointed cutters, (3) conical flat cutters as described in Figure 2 on page 11.

PROCEDURE FOR SHARPENING 60° CONICAL CUTTERS — Set swivel arm to 26° . Insert cutter into collet. Lock halved portion parallel to table and release index unit so that spindle turns freely. Turn cutting edge 30° to 45° above parallel position. Move cutter into grinding position. Feed dial "D" .001" at a time and shape cutter by turning spindle clockwise until tool has been sharpened. Without feeding, keep cutter moving back and forth, turning the spindle gradually until all stock has been removed back of the cutting edge and repeat. When properly ground the cutting edge will always be shorter than the back edge. Care must be taken not to over heat the cutter during the grinding operation as this may anneal the cutting edges.

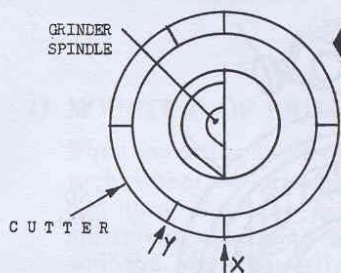
CONICAL POINTED



CYLINDRICAL FLAT

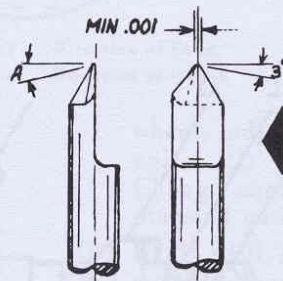


TOP VIEW OF SPINDLE



TIPPING OFF CUTTERS

- 1 - Set index unit at line "x".
- 2 - Insert cutter in collet, halved section parallel with "x".
- 3 - Turn spindle and lock index at "Y".
- 4 - Set swivel arm at 75° and grind tip to size required.



STONING THE POINT

The extreme point of the cutter should always be slightly removed with a fine oil stone. Care must be taken to stone it off at the correct angle so as to leave the highest point at the cutting edge. (see drawing). The same applies to cutters with wider or heavier cutting faces.

HALVING STRAIGHT SHANK CUTTERS (FIG. 1) — Before inserting cutter into collet, release index unit "A" and turn spindle until lock pin engages one of the notches. This prevents spindle from turning while halving the cutter. Lock thumb-screw "C" with graduated swivel-arm "B" at zero. Insert cutter so that flat side is parallel with face of grinding wheel and clamp cutter in this position. During the grinding operation, move cutter back and forth while feeding onto wheel by turning knurled collar "D". All cutters, while being halved, must be accurately measured with a micrometer.

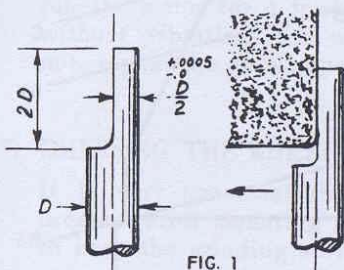


FIG. 1

Experience has proved that the face of the of the cutter may be .0005" oversize to give best results, but should never be ground undersize as this weakens the point and results in repeated breakage. (see drawing)

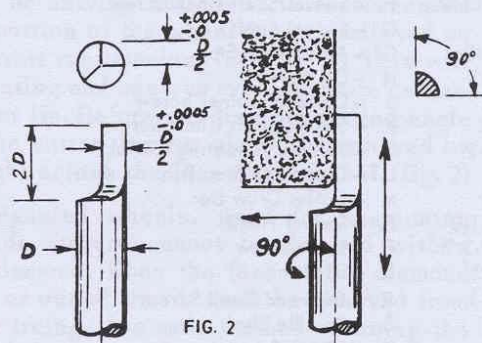
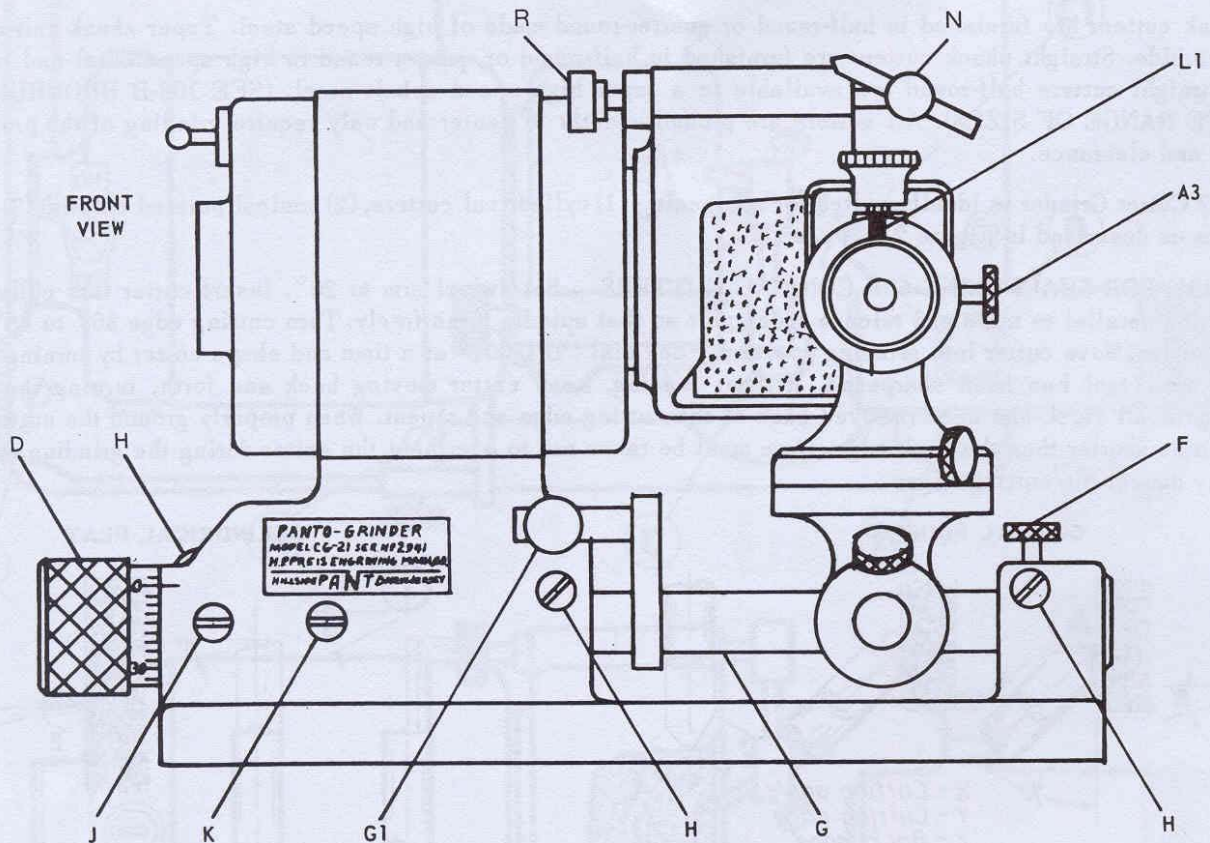


FIG. 2

QUARTERING STRAIGHT SHANK CUTTERS (FIG. 2) — Before inserting cutter into collet, select two notches to form a 90° angle on the two flat sides of the cutter when rotating the spindle from one notch to the next. Clamp the cutter so that one flat side is parallel with face of wheel and proceed in the same manner as instructed for halving straight shank cutters, with the exception that two flats must be ground instead of one.

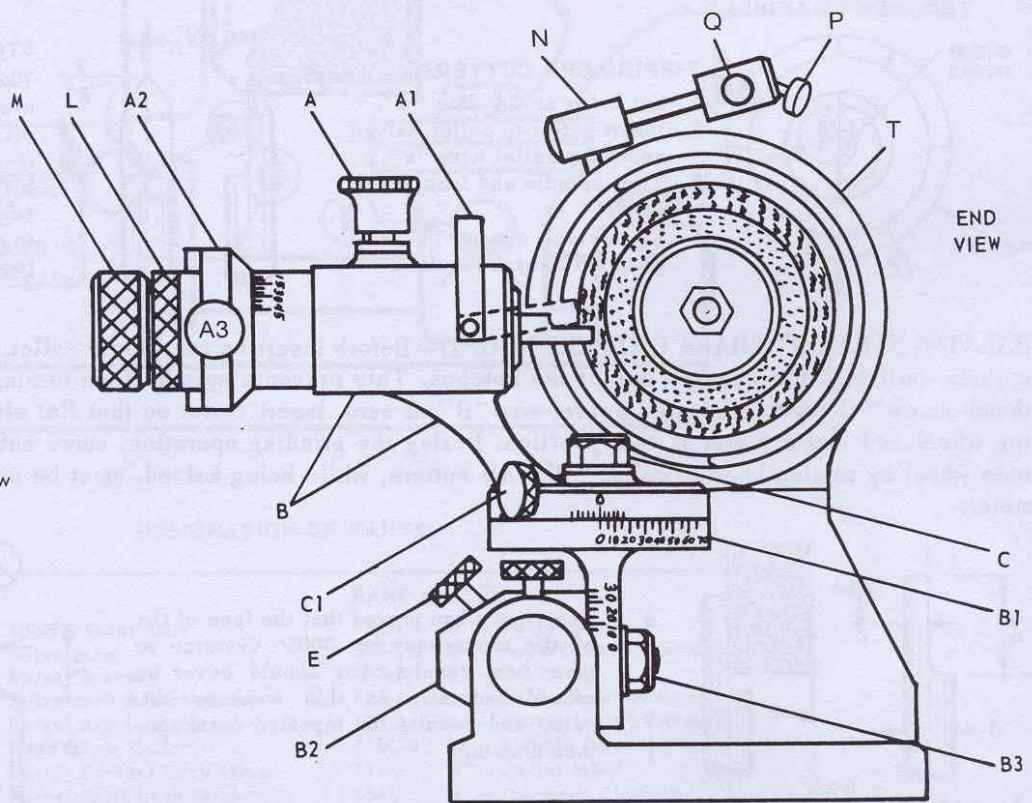
ASSEMBLY DRAWING MODEL CG-21 CUTTER GRINDER



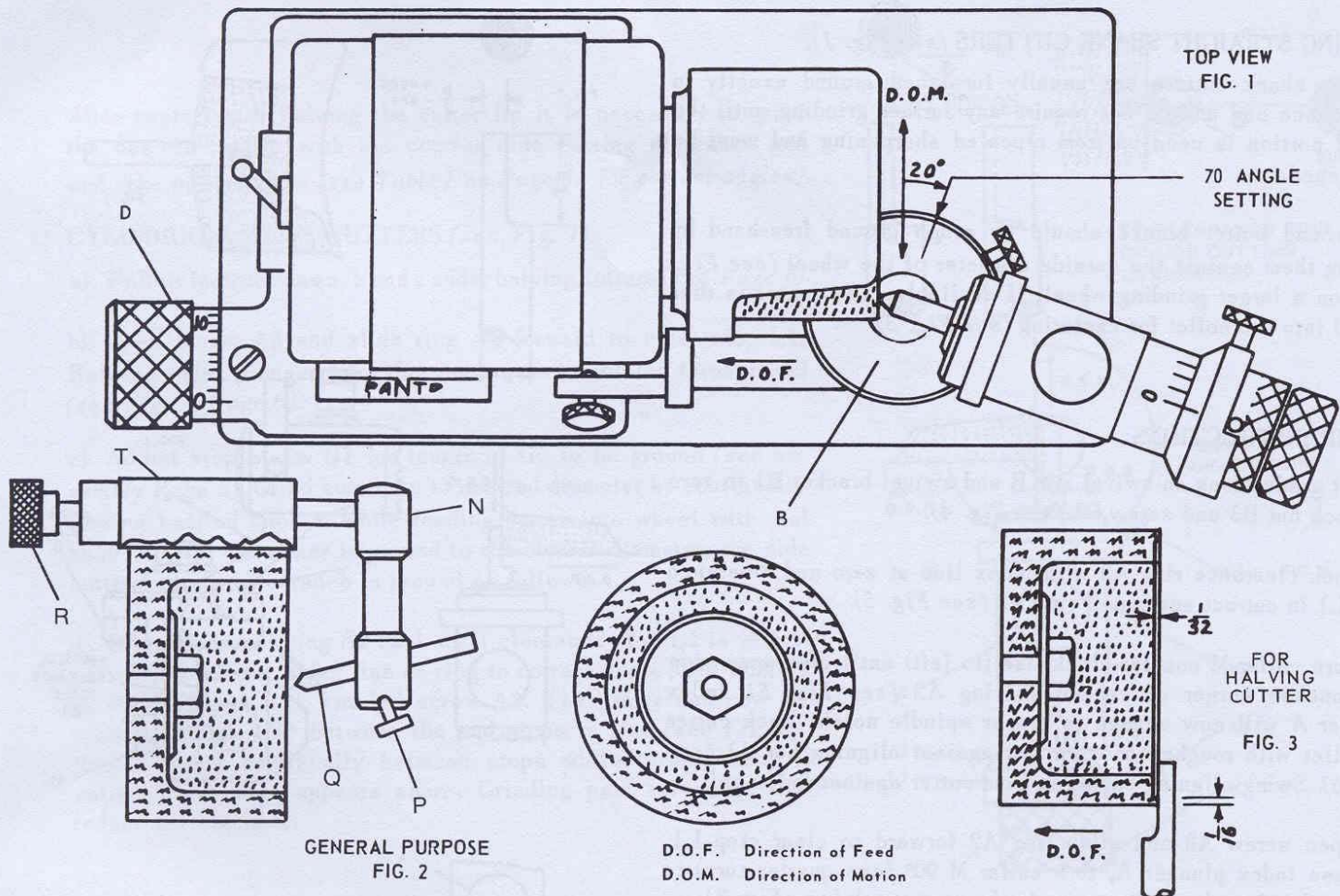
DESIGNATION OF PARTS

PART NO.

122-A	A - Spindle Index Unit
914-2	A1 - Cutter Aligning Bar
914-1	A2 - Clearance Ring
10-32-3/8	A3 - Lock Screw for A2
122-C	B - Swivel Arm
912	B1 - Swivel Bracket
913	B2 - Swivel Support Knuckle
5/16-24	B3 - Lock Nut for B1
ESN-5/16-24	C - Swivel Arm Adjusting Nut
10-32-3/8	C1 - Swivel Arm Lock Screw
123-1	D - Feed Screw Collar
10-32-3/8	E - Swivel Support Lock Screw
10-32-3/8	F - Swivel Shaft Lock Screw
120-1	G - Swivel Shaft
915-1-2	G1 - Adjustable Stop
123-5	H - Oil Holes
123-4	J - Collar Retainer Screw
123-3	K - Swivel Shaft Limit Screw
119C-2	L - Spindle Adjusting Collar
	L1 - Clearance Stop Pin
119-2	M - Collet Draw Bar
1062-1-2	N - Swivel Head
10-32-3/8	P - Lock Screw
106-25	Q - Diamond
1063-1	R - Diamond Feed Screw
119-1	S - Spindle Shaft
1061	T - Wheel Guard



MOUNTING AND DRESSING OF THE GRINDING WHEEL



1) MOUNTING OF GRINDING WHEEL

When mounting a wheel be sure that it runs true. Attach wheel on grinder shaft, lock wheel nut lightly and turn wheel by hand to check run-out. There is sufficient clearance between the bore of the wheel and the shaft for slight adjustment of run-out. For checking run-out insert a cutter in the collet and lock cutter head in such a position that the cutter tip barely touches the outside diameter of the wheel. Find the high spot of the wheel and, with a soft mallet or wooden handle, tap it lightly at this point but at the back of the wheel. Never hit the front or open end of the wheel and never use a metal object. When the wheel appears to run true lock the wheel nut tight and run the motor for a few seconds. If the grinder runs without vibration, the wheel is mounted correct, if not, repeat the above operation.

2) DRESSING THE WHEEL FACE

It is very important that the face of the wheel is dressed after mounting and also at regular intervals to keep the grinding surface clear and true. For this purpose a wheel truing diamond is furnished with each grinder.

(A) WITH PLAIN WHEEL GUARD (OR) WITHOUT BUILT-IN DIAMOND DRESSER lock diamond dresser into collet with swivel arm "B" at 70°-80° (fig. 1). Move diamond point across face of

wheel, adjusting depth of cut with feed screw collar "D" until wheel face is clean and true. Change angle and position occasionally so that diamond cuts at its sharpest point.

(B) WITH BUILT-IN DIAMOND DRESSER swing diamond dresser down from wheel guard. Adjust diamond to touch wheel and lock screw. Turn knurled screw while maintaining light pressure of diamond against wheel and, while dressing, move diamond slowly across face until clean and true. Swing dresser up and rest on wheel guard when not in use.

For centering or halving cutters it is recommended that the back portion of the wheel face is relieved so that only a narrow rim remains. (see fig. 3) This will prevent overheating and assures more accurate centering of the cutter lip. Before grinding the cutting angle or profile on the cutter this rim should be removed by dressing straight across the face of the wheel. (fig. 2)

Diamond impregnated wheels, used for sharpening tungsten carbide cutters cannot be dressed with a wheel truing diamond. When the face of the diamond wheel is worn or out of true it must be removed from the grinder for truing. A simple method of truing the diamond surface is to set the wheel face down on a cast iron plate, charged with emery and oil. Rub the diamond face over this surface, using circular motions, until the face is flat and exactly parallel or true with the back surface of the wheel.

OPERATING INSTRUCTIONS FOR MODEL CG-21 UNIVERSAL CUTTER GRINDER

1) HALVING STRAIGHT SHANK CUTTERS (see Fig. 1).

Straight shank cutters are usually furnished ground exactly in half on one end and do not require any further grinding until the halved portion is used up from repeated sharpening and must be lengthened.

Full round cutter blanks should be rough ground free-hand by holding them against the outside diameter of the wheel (see Fig. 2) or on a larger grinding wheel, if available. The cutter is then locked into the collet for centering (see Fig. 3).

2) SETUP INSTRUCTIONS

a) Set graduations on swivel arm B and swivel bracket B1 to zero and lock nut B3 and screw C1 (see Fig. 4).

b) Lock clearance ring A2 with index line at zero and clearance stop L1 in cut-out section of ring A2 (see Fig. 5).

c) Turn collar M counter-clockwise (to left) until clearance stop L1 touches corner of cut-out in ring A2 (see Fig. 5). Index plunger A will now engage in proper spindle notch. Lock cutter in collet with roughed or worn flat against aligning bar A1 (see Fig. 6). Swing aligning bar away from cutter against index unit.

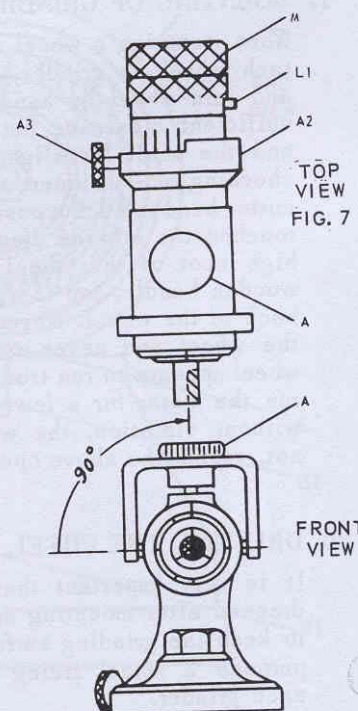
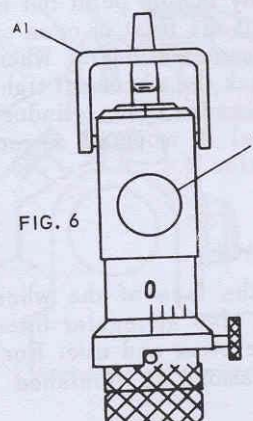
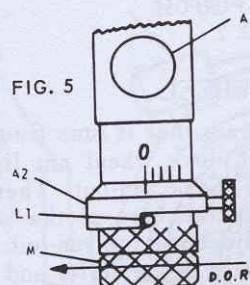
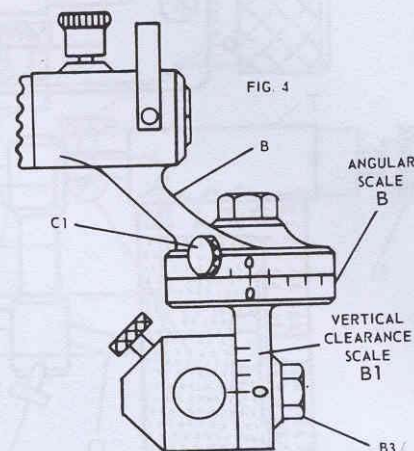
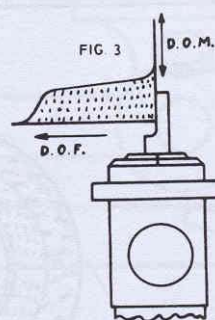
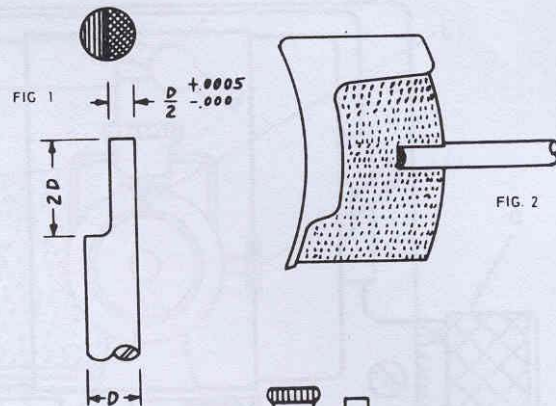
d) Open screw A3 and slide ring A2 forward to clear stop L1. Release index plunger A, turn collar M 90° (one quarter turn) to left until index plunger engages in the next notch (see Fig. 7).

e) Lock screw F and open screw E (see assembly on Page 4). Slide cutter head along shaft G until cutter touches face of wheel and, with stop screw G1 against base, push cutter head forward until cutter travels over the face of the wheel to desired length. Lock screw E and open screw F.

f) Make final adjustment for length of cutter lip with stop screw G1. Feed cutter into the wheel by holding knurled knob M with right hand while turning graduated dial knob D with left hand after each grinding pass. Rock cutter back and forth across the face of the wheel to prevent overheating or annealing (see also dressing instructions for halving cutters). When the cutter lip is finished it must measure exactly one half of the shank diameter (see Fig. 1).

EQUIPMENT REQUIRED FOR GRINDING FACETING CUTTERS 6m/m x 12 m/m

- 1 - 119-25 1/4" collet
- 2 - 110 Special Holder (Poselux Cutters)
- 3 - 2145 Diamond Wheel, 240 grit in periphery of wheel



D.O.F. = Direction of Feed
D.O.M. = Direction of Motion
D.O.R. = Direction of Rotation

GRINDING SIDE CUTTING EDGES ON ALL CUTTERS (except ball or round nose.)

After centering or halving the cutter lip it is necessary to grind the desired profile with the correct side cutting clearance and end rake or clearance (see Table 1 on Page 11 for correct angles).

1) CYLINDRICAL FLAT CUTTERS (see Fig. 1).

a) Follow instructions a, b and c under halving cutters (see Page 6).

b) Open screw A3 and slide ring A2 forward to clear stop L1. Release index plunger A so that cutter can be rotated through 360° (see Fig. 7, Page 6).

c) Adjust stop screw G1 for length of tip to be ground (see assembly Page 4). Grind cutter tip to desired diameter by continually turning knurled knob M while feeding cutter into wheel with dial knob D. After the cutter is ground to the correct diameter, the side cutting edge or clearance is ground as follows.

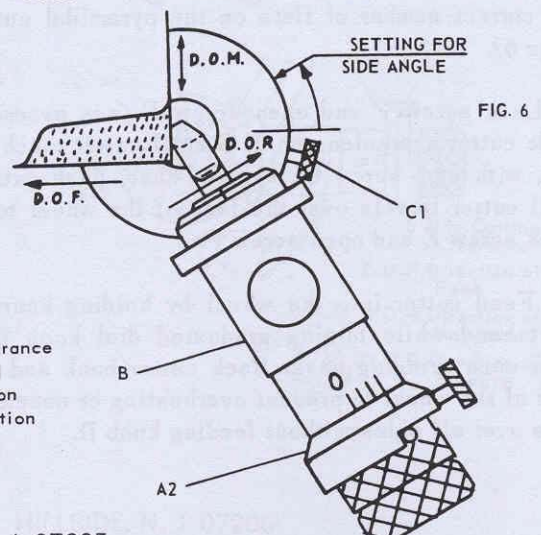
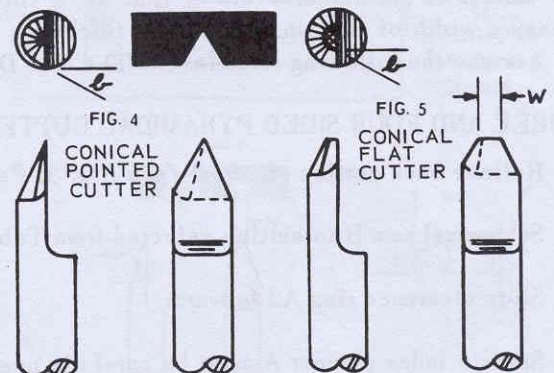
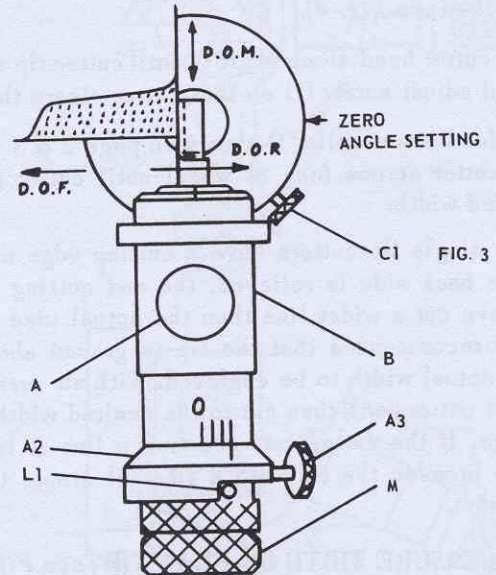
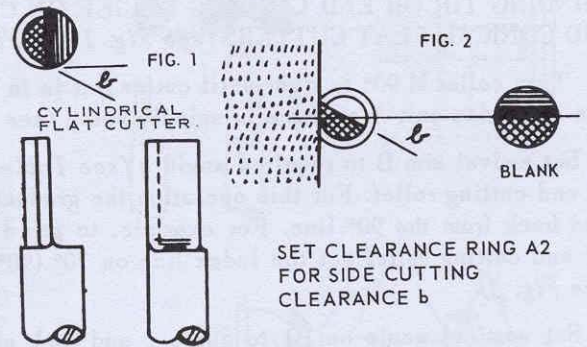
d) Slide clearance ring A2 back until clearance stop L1 is in cut-out of ring A2. Set index line on ring to correct angle (see Table 1 on Page 11) and lock knurled screw A3. The cutter can now be rotated through 180° between the end stops in ring (see Fig. 3). Rotate cutter continually between stops while turning knob D until cutting edge appears sharp. Grinding past this edge will reduce the diameter.

2) CONICAL-POINTED OR CONICAL-FLAT CUTTERS (see Fig. 4 and Fig. 5).

a) Follow instructions in paragraph 1 above.

b) Set swivel arm B to desired angle and lock screw C1. Follow grinding instructions under cylindrical cutters until cutter is pointed or, on conical-flat cutters until tip 'W' is slightly smaller than required (see Fig. 5 and Fig. 6).

Note: If the side angle must be exact it is necessary to set the swivel arm to a lesser angle than required since the cutting angle increases by several degrees when side clearance is set at clearance ring A2. This increase in angle varies and depends largely upon a combination of angle and side clearance. The table 2 on page 11 lists the most commonly used angle and side clearance combinations and in the last column shows the degrees to be deducted from the desired side angle. By following this table side angles will be accurate within $\pm 1^\circ$.



b = Side Cutting Clearance
D.O.F. = Direction of Feed
D.O.M. = Direction of Motion
D.O.R. = Direction of Rotation

GRINDING END CUTTING RELIEF AND END CUTTING RAKE

1) GRINDING TIP OR END CUTTING RELIEF ON CYLINDRICAL AND CONICAL-FLAT CUTTERS (see Fig. 1 and Fig. 2).

- a) Turn collar M 90° to right until cutter flat is in vertical position and index unit A engages in spindle notch (see Fig. 3).
- b) Set swivel arm B to required angle a (see Table 1 on Page 11) for end cutting relief. For this operation the graduations must be read back from the 90° line. For example, to grind a cutter with 20° end cutting relief set the index line on 70° ($90^\circ - 20^\circ = 70^\circ$) (see Fig. 3).
- c) Set vertical scale on B1 to angle c and lock nut B3 for end cutting rake (see Fig. 4).
- d) Slide cutter head along shaft G until cutter tip contacts face of wheel and adjust screw G1 so that cutter clears the inside of rim.
- e) Turn feed screw collar D shown on page 2 & 3 while constantly moving cutter across face of wheel until cutter tip is ground to the desired width.

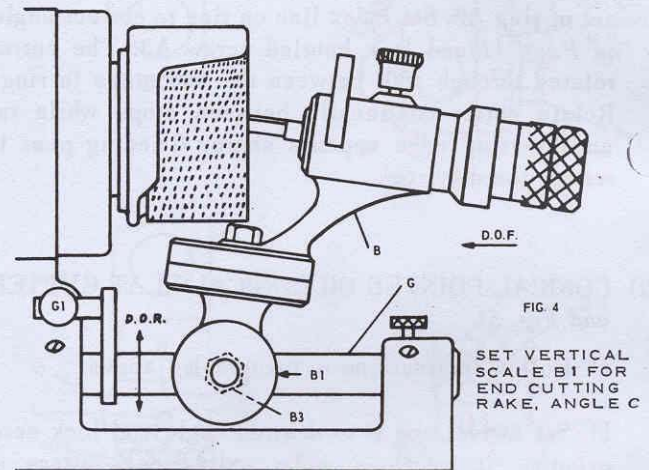
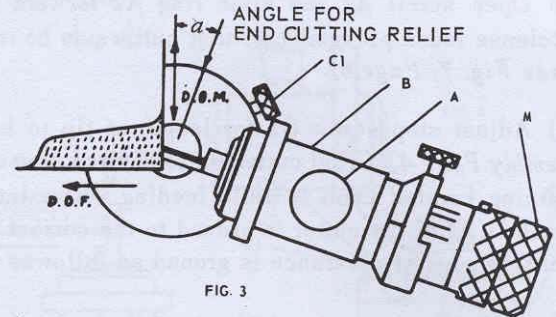
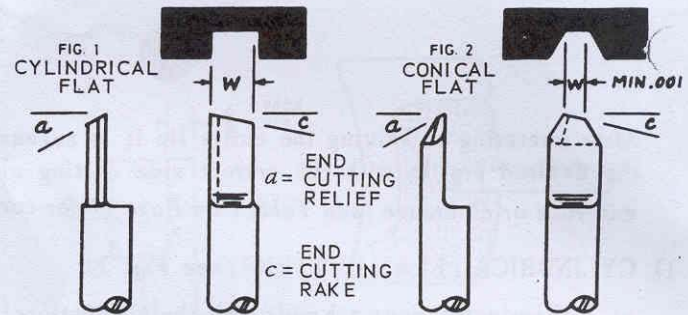
Note: Since single lip cutters have a cutting edge only on one side while the back side is relieved, the end cutting edge or flat tip will always cut a wider line than the actual size of the tip. It is therefore recommended that the tip is ground about 10% smaller than the actual width to be engraved. With an average side clearance most cutters will then cut to the desired width within general tolerances. If the cutter cuts too fine a line it is then a simple matter to broaden the tip with a fine oil stone. (for conical-flat cutters only).

2) HOW TO MEASURE WIDTH OF FLAT TIP (see Fig. 5).

To determine the actual width of line 'D' a cutter will engrave, measure width of flat tip 'W', deduct thickness 'T' and multiply by 2 or use the following formula: $(W - T) \times 2 = D$.

3) THREE AND FOUR SIDED PYRAMIDAL CUTTERS (see Fig. 6).

- a) Relieve back portion of wheel (see Fig. 3, Page 5).
- b) Set swivel arm B to setting selected from Table 1.
- c) Slide clearance ring A2 forward.
- d) Spindle index plunger A must be carefully positioned to assure the correct number of flats on the pyramidal cutter (see Fig. 7, Page 6).
- e) Lock screw F and open screw E (see assembly on Page 4). Slide cutter head along shaft G until cutter touches face of wheel and, with stop screw G1 against base, push cutter head forward until cutter travels over the face of the wheel to desired length. Lock screw E and open screw F.
- f) Feed cutter into the wheel by holding knurled knob M with right hand while turning graduated dial knob D with left hand after each grinding pass. Rock cutter back and forth across the face of the wheel to prevent overheating or annealing. Take final pass over all sides without feeding knob D.



D.O.F. = Direction of Feed
D.O.M. = Direction of Motion
D.O.R. = Direction of Rotation

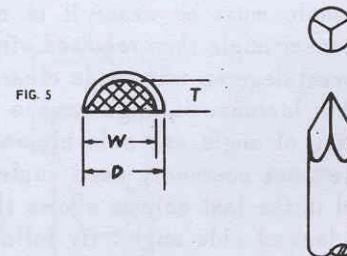


FIG. 6
3 SIDED
CUTTER

TABLE 1

CLEARANCE ANGLES FOR 3 AND 4 SIDED CUTTERS												
SIDE ANGLE (Cutting Angle)	60°	55°	50°	45°	40°	35°	30°	25°	20°	15°	10°	5°
Clearance Angle												
3 Sided	41°	36°	30°	26°	23°	19°	16°	13°	10°	7°	5°	
4 Sided	55°	47°	41°	35°	30°	26°	22°	18°	14°	10°	7°	

GRINDING ROUND OR BALL NOSE CUTTERS

1) CYLINDRICAL SIDES WITH ROUND NOSE (see Fig. 1).

- a) Follow instructions under cylindrical flat cutters (see Page 7).
- b) With all settings at zero (0) grind cutting tip to diameter required.
- c) Without changing setting of feed screw collar D swing swivel arm B from the zero to 90° position.
- d) Reposition the cutter in the collet so that the end of the cutter just contacts the wheel (see Fig. 2). Be sure that the flat side of cutter is still in alignment with aligning bar A1.
- e) Set vertical scale on B1 to angle a (see Table 1 on Page 11) and lock B3 hex nut (see Fig. 4).

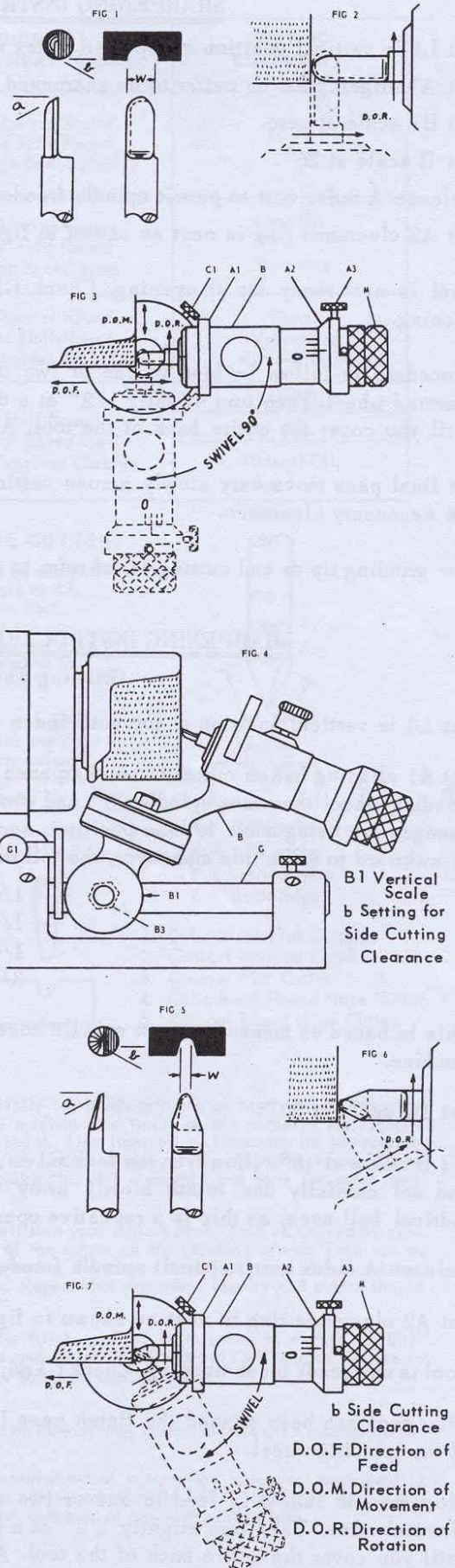
Note: The side cutting clearance may be increased by additional setting of the clearance ring A2 to the desired degrees. Thus the cutter will have an end cutting relief as set at B1 and a side cutting clearance as set at B1 plus A2.

- f) Slide cutter head along swivel shaft G until cutter contacts face of wheel. With swivel arm set at zero (0) grind side cutting clearance until edge appears sharp.
- g) Open screw C1, rotate collar M between limit stops while gradually swinging swivel arm from zero to 90° position (see Fig. 3) without changing setting of collar D.

2) CONICAL SIDES WITH ROUND NOSE (see Fig. 5).

- a) Follow above instruction.
- b) Set swivel arm B to side angle and grind conical shape, leaving a flat tip slightly smaller than the round nose desired (see also conical flat cutters).
- c) Without changing setting of collar D swing swivel arm B to 90° position.
- d) Reposition cutter in collet so that the flat end of the cutter just contacts the wheel (see Fig. 6). Be sure to keep the flat side of cutter in alignment with aligning bar A1.
- e) Set vertical scale on B1 to angle a (see Table 1 on Page 11) and lock hex nut B3 (see Fig. 4). For additional side cutting clearance see note following paragraph 1-e above.
- f) Slide cutter head along shaft G until cutter contacts face of wheel. With swivel arm set at the original side angle, grind side cutting clearance until edge appears sharp. (For exact side angles see note following paragraph 2-b on Page 7).
- g) Open screw C1, rotate collar M between limit stops while gradually swinging swivel arm from angular to 90° position (see Fig. 7) without changing setting of collar D.

Note: Only cutters having cylindrical shanks can be sharpened with round or ball nose since this operation requires the cutter to protrude a given distance out of the collet. Tapered shank cutters, having a fixed position in the collet cannot be sharpened with round nose.



The following examples apply to any angle when grinding single flute engraving cutters on Model CG-21 Cutter grinder.

SHARPENING INSTRUCTIONS FOR 60° CONICAL CUTTING TOOLS

Set L1 in vertical position at top until index unit A engages.

Set A1 aligning bar on cutter to be sharpened and lock in collet.

Set B1 scale at zero.

Set B scale at 26°.

Release A index unit to permit spindle freedom of rotation.

Set A2 clearance ring in nest as shown in figure 3, rotate to clearance angle setting of 40° and lock thumb screw A3.

Tool is now ready for sharpening. Check G1 adjustable stop screw so cutter passes just into grinding wheel cup opening.

Procedure to follow is feed in one or two thousand with D feed screw collar. Oscillate cutter back and forth across diamond wheel. Then turn slightly 1/2° at a time and oscillate cutter back and forth across the diamond wheel. Repeat until you cover the entire back of the tool. After which you turn D feed screw collar and repeat this entire procedure.

On final pass move very slowly across cutting surface and more rapidly as you proceed beyond this point to achieve the necessary clearance.

For grinding tip or end cutting relief refer to *Page 11*.

SHARPENING INSTRUCTIONS FOR CONICAL BALL NOSE 40° CUTTING TOOLS

Grinding Wheel should have 3/4" long cup minimum.

Set L1 in vertical position at top until index unit A engages.

Set A1 aligning bar on cutter to be sharpened and lock in collet. Operating Instruction (d) says set side of tool against grinding wheel then turn spindle 90° and place front of tool against the grinding wheel. It is understood that no other changes are being made to lose position, such as, feeding knob D which would disturb this setting. To help out as it is awkward to make this maneuver, the following dimensions can be referred to.

1/64" Ball Extend Cutter 9/16"

1/16" Ball Extend Cutter 19/32"

1/8" Ball Extend Cutter 5/8"

3/16" Ball Extend Cutter 21/32"

This is based on measuring from spindle nose (not the collet). However, these dimensions will vary slightly with each machine.

Set B1 scale at 20°.

Set B scale at 18°. (However, as lock C1 is left open for swiveling it would be necessary to watch this starting point and set carefully and rotate slowly away from this angle setting for conical ball nose or from 0° setting for cylindrical ball nose, as this is a repetitive operation).

Release A index unit to permit spindle freedom of rotation.

Set A2 clearance ring in nest as shown in figure 3, rotate to clearance angle setting of 10° and lock thumb screw A3.

Tool is now ready for sharpening. Check G1 adjustable stop screw so cutter passes just into grinding wheel cup opening.

After tool has been shaped the finish pass is made while tool is locked in position centrally located on cutting face of the grinding wheel.

Procedure to follow is feed in one or two thousand with D feed screw collar. Oscillate cutter back and forth across diamond wheel. Then turn slightly 1/2° at a time and oscillate cutter back and forth across the diamond wheel. Repeat until you cover the entire back of the tool. After which you turn D feed screw collar and repeat this entire procedure.

On final pass move very slowly across cutting surface and more rapidly as you proceed beyond this point to achieve the necessary clearance.

TABLES AND MISCELLANEOUS INSTRUCTIONS

AS THE EFFICIENT OPERATION OF ANY ENGRAVING MACHINE DEPENDS ON THE PROPER STYLE OF CUTTER USED, WE SUBMIT THE FOLLOWING RECOMMENDATIONS FOR YOUR GUIDANCE:

TABLE 1

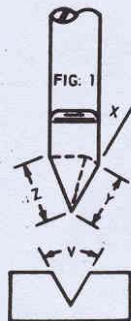
MATERIAL TO BE ENGRAVED	ANGLES SHOWN ON PAGES 7 AND 8			CUTTERS RECOMMENDED		CUTTING LUBRICANT
	a	b	c	FOR FINE LINES	FOR HEAVY LINES	
Engravers Brass Engravers Bronze Half Hard Aluminum	20°	35°	5°	Quarter-Round High Speed Steel	Quarter-Round or Half-Round High Speed Steel	None
Acrylic Plastic, Celluloid	25°	45°	10°			
Copper, Soft Brass Soft Aluminum Nickel Silver Silver & Gold	20°	35°	5°	Quarter-Round High Speed Steel	Quarter-Round or Half-Round High Speed Steel	Lard Oil or Kerosene
Phenolic & Fibreglas Plastic Materials	20°	40°	10°	Quarter-Round or Half-Round Tungsten Carbide	Quarter Round or Half-Round Tungsten Carbide	None (Vacuum to Remove Dust)
Hardrubber, Hardwood	25°	45°	15°			
Wrought Iron, Steel	15°	30°	5°	Half-Round High Speed Steel	Half-Round High Speed Steel or Tungsten Carbide	Lard Oil
Cast Iron, Cast Steel	20°	30°	5°			Air
Alloy Steel, Monel, Stainless Steel	10°	20°	5°			Mineral Oil, Lard Oil

TABLE 2 CHART FOR OBTAINING PRECISE CUTTING ANGLES ON CONICAL CUTTERS

INCLUDED ANGLE V DESIRED	SIDE ANGLE X TO BE CUT	SIDE CLEARANCE SET AT A2	DEDUCT FROM DESIRED SIDE ANGLE
20° - 40°	10° - 20°	25°	- 1°
50° - 60°	25° - 30°		- 2°
70° - 90°	35° - 45°		- 3°
20° - 40°	10° - 20°	30°	- 1½°
50° - 60°	25° - 30°		- 3°
70° - 90°	35° - 45°		- 4°
20° - 40°	10° - 20°	35°	- 2°
50° - 60°	25° - 30°		- 4°
70° - 90°	35° - 45°		- 5°
20° - 40°	10° - 20°	40° *	- 3°
50° - 60° *	25° - 30° *		- 5° *
70° - 90°	25° - 45°		- 6°

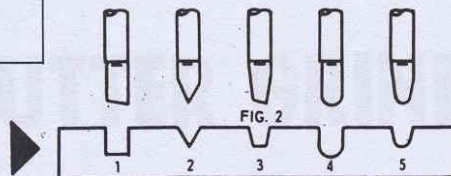
When grinding side clearance on conical shaped cutters by setting angle at A2, the actual cutting angle varies from the setting. This table shows the variations at different angles and the last column lists the number of degrees to be deducted from side angle "X".

*For example: Grinding cutter with 30° side angle (60° included angle) and 40° side clearance. Deduct 5° (last column) from 30° side angle and set swivel arm B at 25°. (see also note on page 7).



V = included angle
X = side angle
Y = cutting edge
Z = Back Edge

The drawing shows five shapes principally used on engraving, profiling, routing and high speed milling machines. (Fig. 2).



1. Cylindrical Flat Cutter.
2. Conical Pointed Cutter.
3. Conical Flat Cutter.
4. Cylindrical Round Nose Cutter.
5. Conical Round Nose Cutter.

SHARPENING HINTS

- 1) Have you dressed the wheel?
- 2) Do not grind or use coarse stone on flat surface after cutter is halved. Polish cutting edge with fine Arkansas stone.
- 3) Cutters with insufficient side clearance, end rake, and end relief will not cut properly (see table 1 above).
- 4) Additional cutting clearance may be hand-ground or stoned with a coarse stone (India stone). Just remove any stock at back of cutter without touching cutting edges.
- 5) All cutting edges including tips must be stoned or finish-honed with a fine Arkansas stone after grinding. This will increase the life of the cutter and improve cutting action.
- 6) Make the proper selection of grinding wheels for high speed steel cutters. A 260V for roughing; 280V for all purpose and 2100V for fine finish, or 2150V for extra fine finish.
- 7) Tungsten carbide cutters require special grinding wheels. A No. 2120CR crystolon wheel may be used for rough grinding only. For finish grinding use diamond impregnated wheels as

follows: No. 2215DF for rough grinding or heavy stock removal; No. 2245DF for medium fine finish or all purpose; No. 2255DF for extra fine finish. Use light oil or kerosene for lubricating while grinding to increase life of the diamond wheel. Hone cutting edges with No. 600 diamond hand hone for extra long wear.

- 8) Overheating will turn your cutters blue. This is caused by constant contact of the cutter on the grinding wheel. This can be corrected by passing the cutter slightly beyond the wheel forward and back. Repeat this procedure rapidly and cutter should not overheat.
- 9) Does the cutter fit the collet? Differences in excess of .001" between cutter and collet or worn collets will cause cutters to run out of true. Solution: replace collet.
- 10) Spindle should be periodically tested for end play, and adjusted.
- 11) For proper measurement of cutters the following equipment is necessary: one scale marked off in 1/64", one 1/2" micrometer and one 3 power eyepiece or one with graduations.

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