OPERATING INSTRUCTIONS

SINGLE LIP CUTTER GRINDER

SO

Contents

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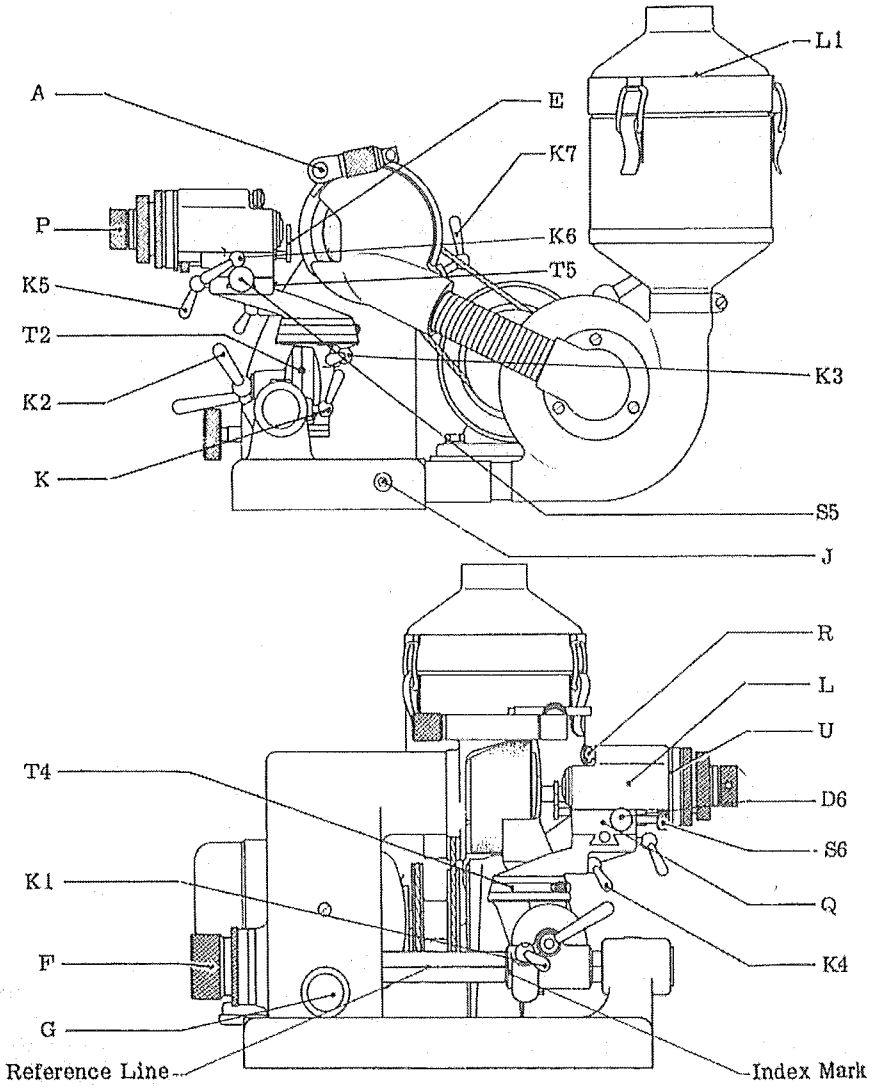
This Instruction Book is Intended for Machine Nr. . . . . .

FEINMECHANIK GMBH

Weilheim/Obb

LIZENZ DECKEL

Names and Explanation of Controls



A Wheel Dressing Attachment
P Spring Collet Clamping Quill
K 5 Cross Slide Clamping Lever
T 2 Vertical Swivel Mount Setting Scale
K 2 Index Drum T2 Clamping Lever
K Tubular Rail Clamping Lever
T 4 Horizontal Swivel Mount Index Drum
K 1 Vertical Swivel Mount Clamping Lever
F Index Head Bracket Fine Adjustment Screw
G Adjustable Stop Screw
L 1 Air Filter
E Cutter Lip Aligning Gauge
K 7 Mouthpiece Clamping Lever
K 6 Longitudinal Slide Clamping Lever
T 5 Cross Slide Vernier Scale for Off-Center Radii
K 3 Horizontal Swivel Mount Clamping Lever
S 5 Cross Slide Adjustment Screw
J Hexagon Socket Screw for Adjusting Blower Cord Tension
R Spring Collet Index Pin
L Longitudinal Slide
U Red Dot Window
D 6 Index Head Slide Fine Adjustment Screw
S 6 Longitudinal Slide Micrometer Screw
Q Cross Slide
K 4 Index Drum T4 Clamping Lever

Note: For easy reference fold out second copy of this sheet provided at the end of this instruction book.

Overall Dimensions - Specification

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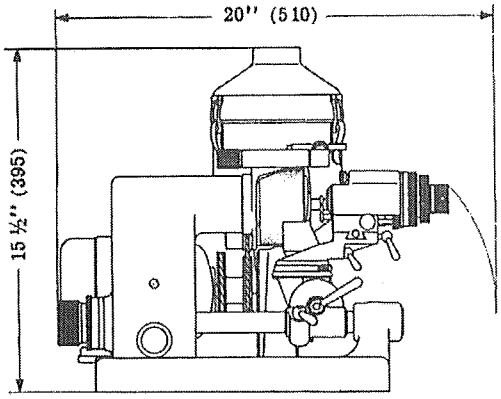

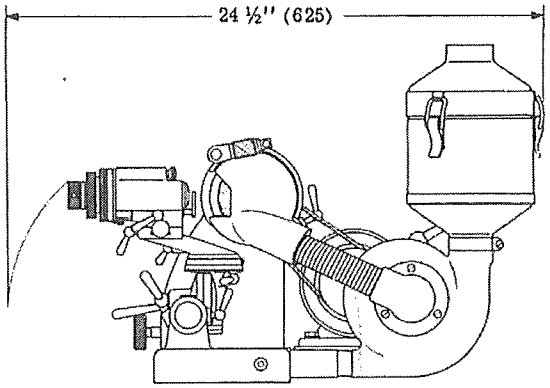

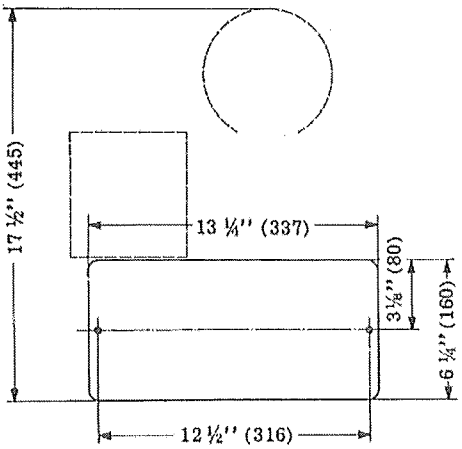

Items in parenthesis are given in mm.

Spindle Drive	Motor capacity	0.2 kw	
	Motor speed	2800 rpm	
	Spindle speed	4500 rpm	
Blower	Blower speed	7500 rpm	
Work Capacity	Max. collet hole in diameter	5/8''	17,5 mm
	Taper hole of adaper sleeves	G1, G2 or GA	
	Max. radius ground (worn wheel permits greater radius)	0.39''	10 mm
	Coarse adjustment of index head bracket on tubular guide	3.9''	100 mm
	Max. lateral traverse of index head	0.39''	10 mm
	Max. longitudinal traverse of index head	1.57''	40 mm
	Max. relief angle approx.	60°	
	Max. fine adjustment of index head bracket parallel to spindle axis	0.59''	15 mm
	Number of index registers	12	
Dimensions and Weights	Length x width x height	13.3'' x 17.7'' x 15.5''	337 x 450 x 395 mm
	Net weight	62 lbs.	28 kg
	Weight of machine, boxed	117 lbs.	53 kg
	Box dimensions	18.9'' x 24.8'' x 17.3''	480 x 630 x 440 mm

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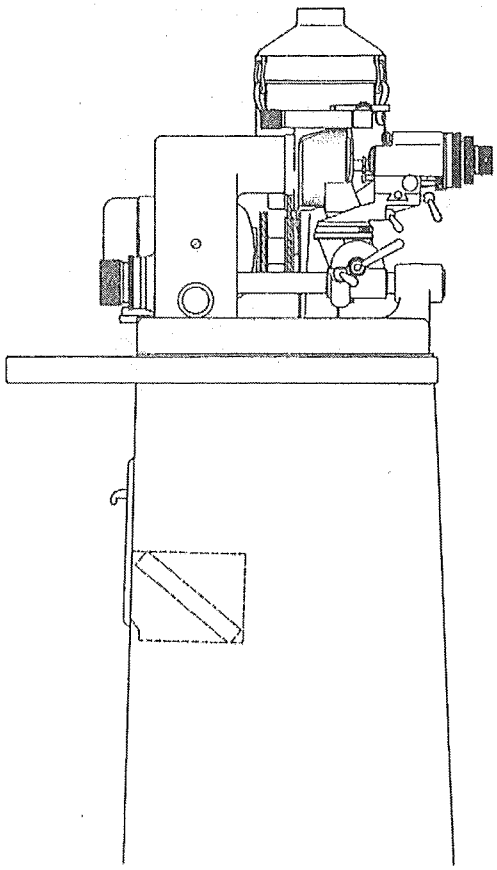
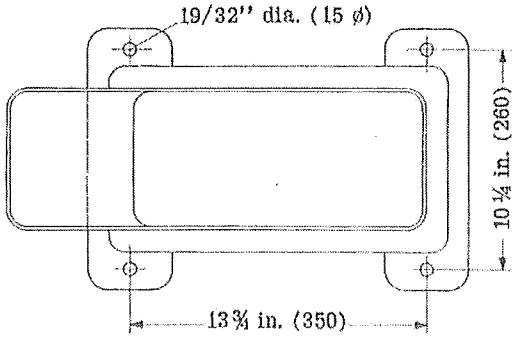
Model SO Single-Lip Cutter Grinder Mounted on Pedestal - Dust Exhaust System

For cases in which it is not intended to mount the SO grinder on a work bench, a stable box-type pedestal is available. This pedestal is of welded all-steel construction and has been designed to eliminate vibration. It permits the grinder to be placed at any point of the workshop floor and to support it at a level which is most convenient for the operator. The diagram to the right shows the position in which the machine should be secured to the pedestal by means of two bolts inserted from above.
The pedestal includes a convenient tray for tools and the like and has a hinged accessory box.

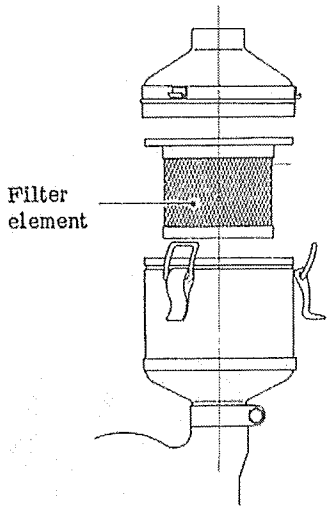


Overall height of Pedestal: 38½ in. (980 mm)
Dimensions of Pedestal Base: 17¾ in. x 11¾ in. (450 x 300 mm)
Weight, approx.: 77 lbs. (35 kg)



Dust Exhaust System

The dust exhaust system with which the single-lip cutter grinder is fitted includes a blower which is directly driven from the spindle motor, and a vertically mounted air filter. The air which is laden with dust particles is drawn into a mouthpiece positioned in the grinding zone and is further drawn through a flexible metallic hose and a filter element where the dust particles are retained, the cleaned air leaving the filter. While the major portion of the heavier particles are trapped between the filter casing and the filter element, the fine particles are retained by the highly effective filter element which is wetted with "Viscinol".



The filter should be cleaned at suitable intervals depending on the amount of use. To clean the filter, release the three snap locks, remove the cover and lift out the filter element. Then remove loose dust from the filter element and from the interior of the casing: then clean the element thoroughly in "Purinol" or hot soda solution, allow it to dry completely and finally wet it again with Delbag "Viscinol A30" air cleaner wetting compound. Then reassemble the air filter.
The dry-layer filter element retained in the cover may be removed for cleaning or replacement after the snap ring has been removed. This filter element should be lightly tapped to remove the adhering dust particles, whereupon it may be used again.
To tighten the circular drive belt of the blower, back off the hexagon socket screw J (see page 2) and use a hexagon socket screw spanner inserted through a hole in the pedestal to change the position of the blower as required.

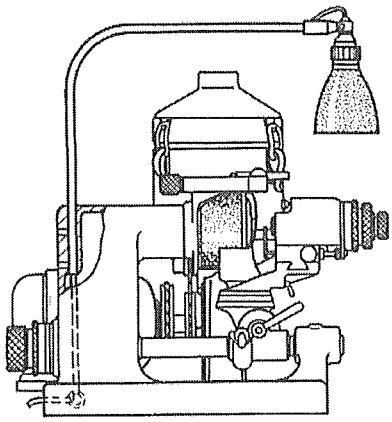


Fig. 1

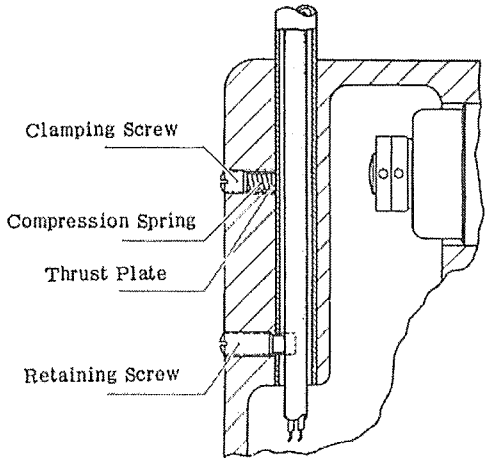
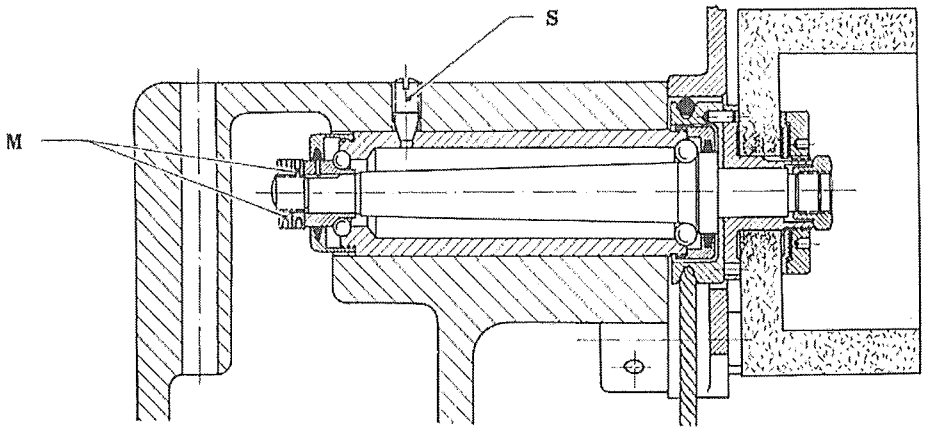


Fig. 2

Installation of Machine Lamp

The Model SOZL lamp furnished with the machine is wired ready for use. Slide lamp tube into vertical bore provided in upper portion of machine. Push tube down until retaining screw registers with tube slot. Insert thrust plate and compression spring and tighten clamping screw (see Fig. 2). Thread cable through hole in machine base and connect to lighting circuit (see Fig. 1).

After placing the machine on a suitable workbench, connect the motor cable to the motor terminals.



The grinding wheel spindle is provided with an ample supply of grease for about 3000 hours of operation. After that time, remove the spindle (see below), disassemble and clean it (with pure, filtered petrol or benzine to which a small amount of spindle oil has been added). To lubricate the ball cages, use a small amount of the prescribed grease (see Lubrication and Maintenance Schedule p. 6).

The spindle bearing has been factory-adjusted to exclude play while allowing for a free-running spindle. In the event some play develops in the course of time, such play should be taken up by tightening the two nuts M. For this purpose, pull the spindle from its seat after having loosened screw S and removed the parts as indicated in the illustration page 6. When tightening the nuts allow for a free-running spindle. Excessive tightening would result in bearing failure. After re-inserting the spindle assembly, carefully tighten screw S in the bore, to hold the spindle assembly in position

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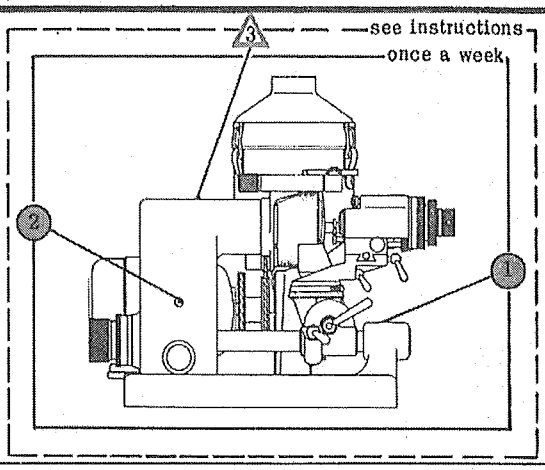
Lubrication and Maintenance Schedule - Changing Drive Cords and Grinding Wheels

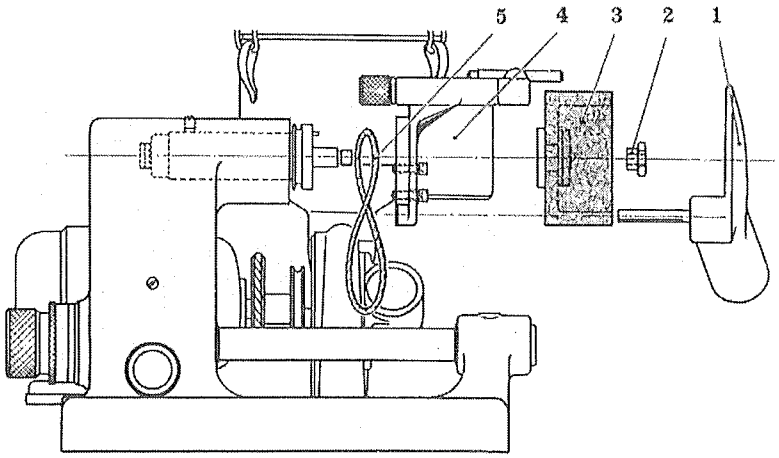


The intervals given apply for single-shift operation.

Recommended Lubricants		
Specification	Quality	Symbol
Bearing Oil	4,5 E/50°C	●
Special Spindle Bearing Grease	ISOFLEX SUPER TEL	△

The grease nipple has already been serviced at the factory.

Interval	No.	Item to be lubricated	Quantity of lubricant	Remarks	Details
1 Week	1	Bearing of index head carrier adjustment	1/3 cu. in. approx.	Use oil can	
1 Week	2				
see instructions	3	Grinding wheel spindle			p. 5



When changing the drive cord, proceed as follows:

1) Remove mouthpiece after having loosened the locking handle on the wheel guard. For this purpose, first loosen the set screw and remove the hose.
2) Loosen and remove the hexagon nut
3) Remove grinding wheel
4) Remove wheel guard after having loosened the hexagon socket screws
5) Exchange drive cord

To re-assemble parts, reverse the above procedure.

To increase the tension of the drive cord, adjust motor bracket (loosen hexagon socket screw).

The grinding wheel can be pulled off after having removed mouthpiece 1 and loosened screw 2.

Grinding wheels are attached to the spindle nose by means of a wheel mount which is placed on the spindle nose with the grinding wheel in position and secured by means of a nut.

Slight out-of-round of the grinding wheel can be taken care of by truing the wheel by means of a diamond or carborundum dresser. Vibration-free operation will greatly extend the service life of the machine.

Servicing the Index Head Bracket

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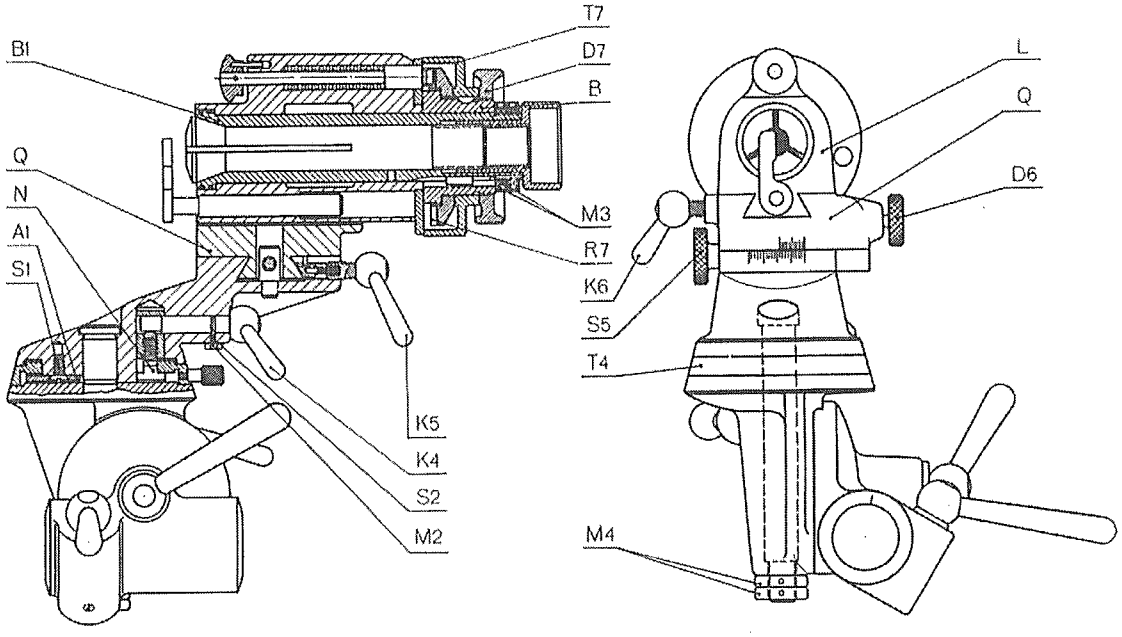

General

After a major period of use it will be necessary to dismantle the index head bracket and to clean and lubricate the moving parts. Particular attention should be given the collet sleeve bearing, the index head slide, and the swivel arm.

Collet Sleeve Bearing

To remove the collet sleeve proceed as follows: Remove ring nut D7, index drum T7, and index ring R7 in that order. Remove two nuts M3. Pull out index ring bearing sleeve B and collet sleeve B1. The annular grease chamber in the longitudinal slide L which has thus been made accessible will then have to be cleaned with gasoline (petrol) and refilled with heavy grease.

Index Head Slide

Release clamping screw K6 and remove screw D6. Pull out longitudinal slide L. Clean all working surfaces, smear lightly with oil, wipe dry. Cross slide Q cannot be removed. Release clamping screw K5 and turn screw S5 to move the cross slide to its extreme positions. Clean the bearing surfaces, smear lightly with oil, wipe dry.

Swivel Arm

To remove the swivel arm and the index head as a unit remove the two nuts M4. Clean the bearing surfaces and smear them with oil.

Adjusting the Clamping Mechanism of the Swivel Arm Index Drum

If after a major period of use clamping lever K4 should no longer lock swivel arm index drum T4, screw N will have to be adjusted. For this purpose proceed as follows: Remove swivel arm as described above; remove screw S1 and plate A1; back off nut M2 and screw S2 and pull out clamping lever K4. Lift off index drum T4 to pull out adjusting nut and screw N. Rotate screw 180° relative to nut to reduce the length. -To reassemble parts reverse this procedure.

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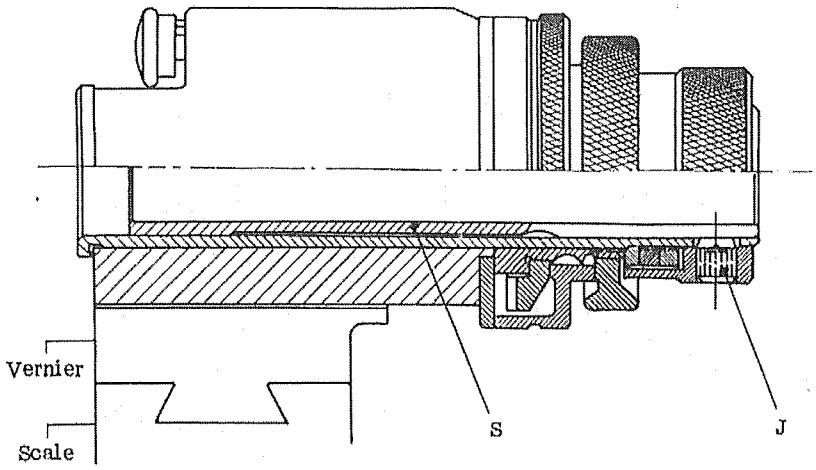
Special Index Head and Spindle Assembly Locating Fixture for Index Head Bracket

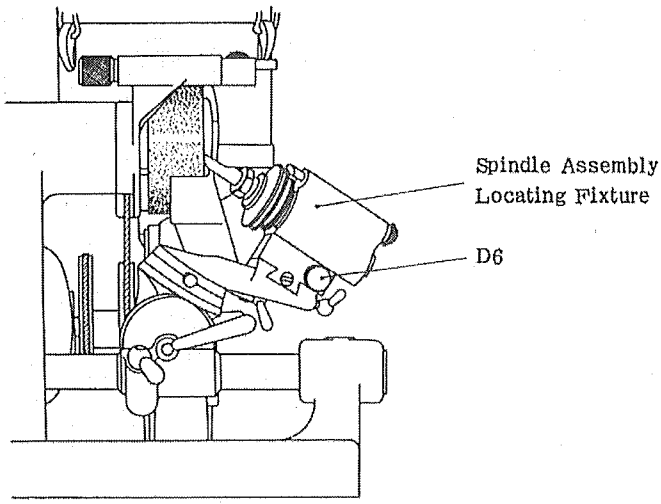


For receiving cutters having diameters of 18, 20 and 25 mm (5/8'', 3/4'', 1'') a complete special index head for the index head bracket of the SO-machine can be delivered. Cutters having diameters of 18 and 20 mm (5/8'' and 3/4'') are held in the index head by means of a clamping sleeve S, whereas cutters of 25 mm (1'') in diam. are directly received in the index head.

Tools are held in position by tightening the two hexagon socket screws J.

Exchanging the index heads will cause an eccentricity which must be examined as follows:
Set scale of cross slide at zero, insert an arbor of 12 mm (1/2'') in diam. into the standard index head so that the arbor is tangent to the grinding wheel.

Then exchange the index head and insert an arbor of 18 mm (5/8'') into the clamping sleeve of the new index head. Then move the cross slide until the arbor is tangent to the grinding wheel. The value which can be read above or below the 3 mm (aprox. 0,1'') mark on the scale of the cross slide indicates the eccentricity to be found. That value must be taken into consideration for each setting when using the special index head.



The spindle assembly locating fixture permits single-lip cutters to be ground while held in the cutter spindle. For this purpose, remove the longitudinal slide from the index head bracket after having loosened screw D6 and clamp K6 and insert the spindle assembly locating fixture into the V-shaped groove of the index head bracket. For grinding operations the spindle assembly together with the single-lip cutter is inserted into the spindle assembly locating fixture and locked in position. The index pin is engaged in the notches provided on the cord pulley of the spindle assembly.

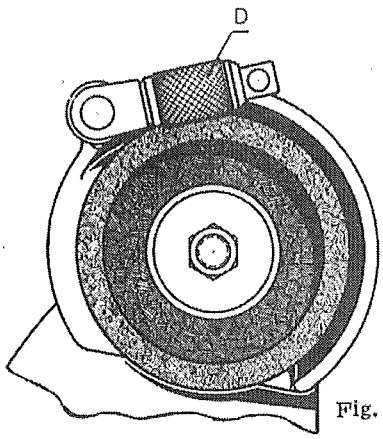


Fig. 1

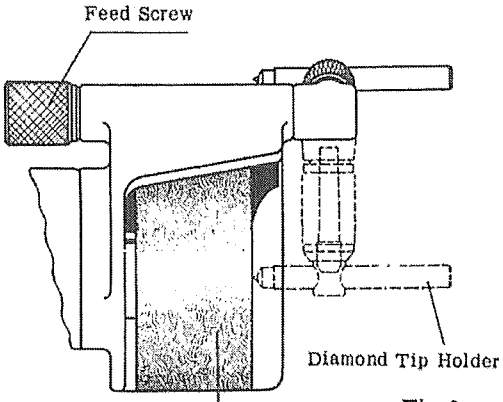


Fig. 2

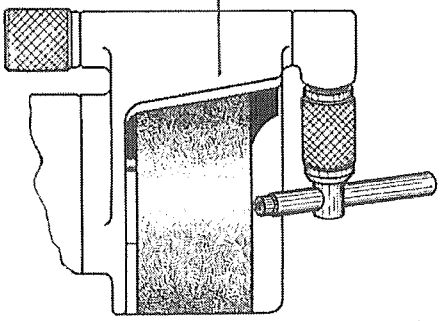


Fig. 3

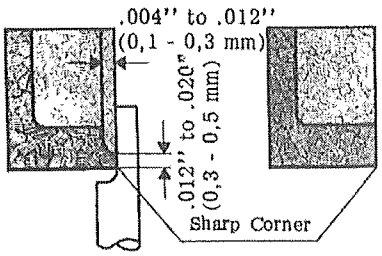


Fig. 4

Wheel truing and dressing should be performed at regular intervals. Dressing is done by means of a diamond set in a tip which is held in a swiveling rod. The latter is attached to a swinging arm which is provided with a feed screw. The diamond tool assembly is supported by the wheel guard (see Figs. 1 and 2). Wheel truing and dressing is particularly necessary when the wheel has become loaded or when the sharp corner has been worn off. Failure to comply with this rule will result in poor surface finish and overheating of the cutting tools.

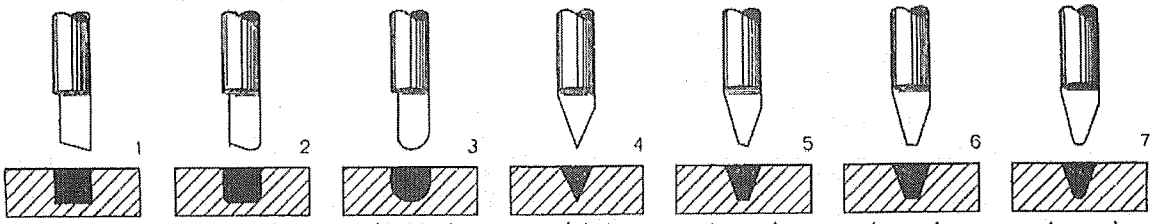
Always be sure to use a sharp-pointed diamond having the proper clearance angle. The wide range of diamond adjustment ensures economical utilization of diamonds. As will be seen from Fig. 3, the diamond can be set at any desired position relative to the grinding wheel, since it can be rotated about its axis and set for endwise position. To reset the diamond back off nut D to release the tapered shank of the diamond holder. After resetting be sure to tighten nut D. Care should be exercised not to allow the wheel to attack the tip in which the diamond is set. When centering the lip surface of a single-lip cutter it is necessary to relieve the wheel face exept for a narrow rim portion (see Fig. 4). This will exclude overheating of the tool being ground.

Prior to finish grinding the cutter be sure to remove the rim portion.

Cutter Profiles – Tool Angles – Cutting Speeds

Cutter Profiles

As a rule, single-lip milling cutters are given one of the seven basic profiles illustrated below:

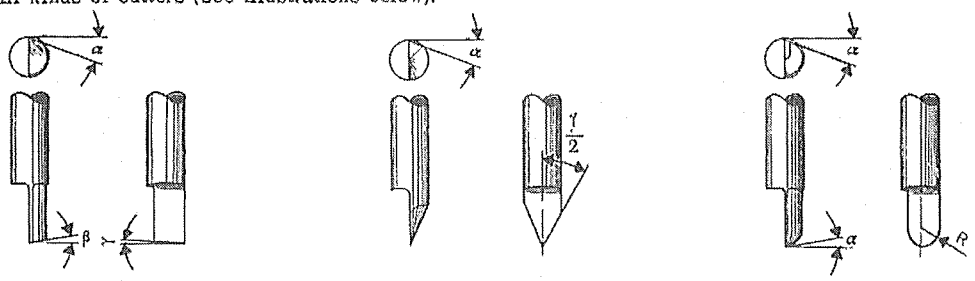


1 cylindrical, w/end relief
2 cylindrical w/off-center radius
3 cylindrical rounded off
4 pointed
5 tapered, w/end relief
6 tapered, w/off-center radius
7 tapered, w/rounded point

Above are illustrated the seven basic cutter profiles and cross-sectional views of the profiles they will produce.

Tool Angles

As is the case with all metal cutting tools, single-lip milling cutters require the proper amount of cutting edge relief or back rake angle for maximum stock removal and high surface finish. As regards single-lip cutters, three different tool angles will have to be taken care of, these angles being used in all kinds of cutters (see illustrations below).



Cutter w/End Relief

Cutter w/Pointed End

Rounded-Off Cutter

Angle β applies for end relieved cutters only. Cutters having an angle α of less than 20° should be relief ground at between 25° and 30° (see special instructions).

Tool Angles and Recommended Cutting Speeds for Single-Lip Cutters

Material to be cut		Tool Angles α	β	γ	Recommended Cutting Speeds for High Speed Steel Single Lip Cutters, sfm Roughing Cut	Finishing Cut
Grey cast iron Cast steel Malleable cast iron		25°	15°	5°	195	260
Machinery steel 47,000 to 85,000 psi					230	295
85,000 to 115,000 psi					195	230
over 115,000 psi					130	165
Tool steel	soft grade				195	260
	hard grade				165	230
Brass Ms 58	soft grade	30°	15°	5°	655	820
	hard grade				820	1150
Brass Ms 63	soft grade				395	490
	hard grade				490	590
Bronze	soft grade				525	655
	hard grade				655	755
Aluminium	soft grade	35°	15°	5°	655	985
	hard grade				820	1150
Wood					985	1150
Plastics: Trolon		25°			820	985
Pertinax, Fiber		35°			655	820
Pollopas, Resopal					655	985
Astralon, Celluloid, Plexi		45°	25°	20°	655	1150

Cutting Speeds

As regards single-lip milling cutters, it is recommended to use cutting speeds three times higher than those used with standard type milling cutters. The data which are tabulated beside should be used as a guide only, as such factors as drive conditions and available spindle speeds will also have to be taken into consideration. In end cutting edges the cutting speed will decrease towards the cutter center line. This effect is particularly noticeable in rounded-off cutters. As a consequence, care should be taken that stock is preferably removed by the outer portion of the cutting edge. For example, where inclined surfaces are concerned, stock should preferably be removed by milling in an upward direction rather than downward.

When cutting soft aluminium, petroleum (kerosene) has to be used as a coolant. When cutting celluloid, the cutter must always be in feed motion, in order to avoid inflammation.

Centering the Cutter Lip by Grinding

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Cylindrical single-lip milling cutters are supplied by the manufacturer with the lip preformed by rough milling (see Fig. 1). As a result, the cutter lip will first have to be accurately centered by grinding. Rough grinding of the lip is performed manually by holding the cutter against the circumference of the grinding wheel (see Fig. 2). This operation is followed by finish grinding in the machine. The off-center tolerance is ± .0004" (0,01 mm) which should be checked with a micrometer caliper (see Fig. 3). To grind the cutter lip correctly, proceed as follows:

Setting-Up

1. Set swivel arm and index drum T4 at zero, tighten clamping lever K3; set vertical setting scale T2 at zero, tighten clamping lever K2. (see Fig. 4).
2. Bring red dot into window U, have index pin R engage the central hole (see Fig. 5).
3. Set cutter with aligning gauge E, clamp cutter in position, return aligning gauge E. (see Fig. 6)
4. Withdraw index pin R, rotate spring collet bearing 180°, allow index pin R to engage the central hole.
5. Tighten clamping lever K, release clamping lever K1. Shift index head bracket along tubular rail to bring cutter lip into light contact with end face of grinding wheel. Be sure, prior to tightening clamping lever K1, to align vertical swivel mount index mark with reference line on tubular rail. Tighten clamping lever K1, release clamping lever K.

Centering the Cutter Lip

6. Fine adjustment screw F serves to set the index head accurately relative to the wheel and to provide the desired depth of cut. The travel of the cutter past the wheel can be limited by means of adjustable stop screw G. Thus it is possible, during grinding to advance the cutter as far as it will go. To bring the cutter lip within the prescribed off-center tolerance, reciprocate the index head bracket while advancing the cutter by rotating fine adjustment screw F.

   In order to prevent the cutter from being overheated, it is recommended to leave only a narrow cutting zone on the grinding wheel (see Page 5 "Wheel Dressing Instructions"). The length of the cutter lip should equal one and one-half times the diameter of the cutter.

   It is not advisable to increase the length of the cutter lip beyond a certain limit. In the case of deep engraving work where stepped cutters are used the shank of the cutter will be increased instead of the lip.

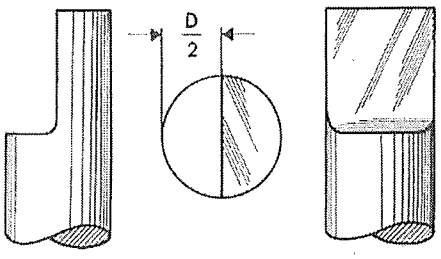


Fig. 1

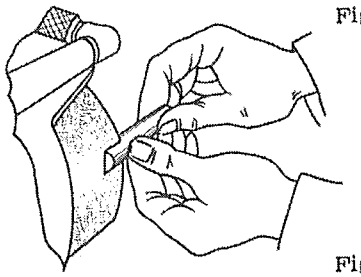


Fig. 2

± .0004" (0,01 mm)

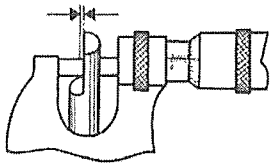


Fig. 3

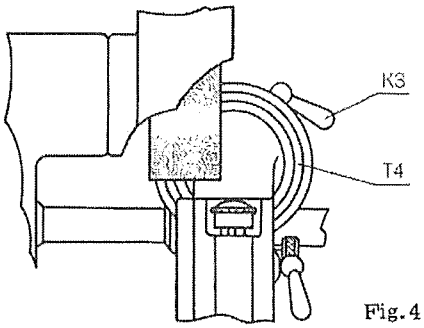


Fig. 4

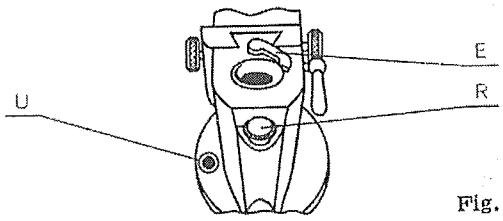


Fig. 5

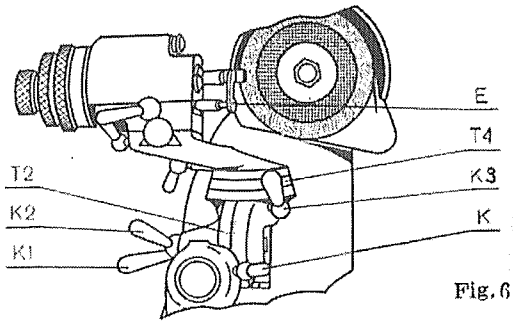


Fig. 6

Circular Grinding of Cutters –

Grinding the Back Rake Angle of Side Cutting Edges

After centering the cutter lip it will be necessary to grind the back rake angles of both the side cutting edge and the end cutting edge. The back rake angles of both cutting edges should be selected to suit the material to be cut (see page 10).

To grind the back rake angle of the side cutting edge of cylindrical cutters (Fig. 1) proceed as follows:

Setup Operations

1. Rotate swivel arm to set index drum T4 at zero; tighten clamping lever K3.
2. Bring red dot into window U; engage index pin R into central hole.
3. Align cutter by means of gauge E; grip cutter in position; return gauge E, see Fig. 2.
4. Release clamping lever K2; set swivel arm at desired back rake angle, using setting scale T2; tighten clamping lever K2, see Fig. 3.
5. Tighten clamping lever K; release clamping lever K1; shift work fixture on tubular rail to bring cutter into light contact with grinding wheel.

   Align index mark of vertical swivel mount with reference line on tubular rail; tighten clamping lever K1; release clamping lever K.

Circular Grinding

6. Engage index pin R into right-hand hole; grind desired diameter by rotating spring collet bearing through 360°. During this operation slowly rotate adjustable stop screw G, while continuously rotating the spring collet bearing, to advance the work fixture past the grinding wheel; this will produce uniform stock removal. Fine adjustment during circular grinding is by screw F. Stop screw G is used to establish the length of the cylindrical portion which should always be slightly longer than the cutting lip.

Setup Operations

7. Return red dot into window U; engage index pin R into left-hand hole to enable the collet bearing to be rotated 180° between the index plate stops.

Grinding the Back Rake Angle

8. When grinding the back rake angle, use the fine adjustment screw F over the entire range of rotation of the collet bearing (see Fig. 3a). Production of the back rake angle is positively controlled. The angle is required to extend over the entire length of the cutting lip.

   The vertical swivel bearing, which permits the work holding fixture to be swung back, enables relief angles up to 40° to be produced. Relief angles over 40° can be obtained by additionally rotating the collet bearing in the index head. (Only for cylindrical or conical cutters with straight end cutting edges or for pointed cutters.)

Upon completion of grinding operations a very narrow land must remain at the cutting edge (see Fig. 4)

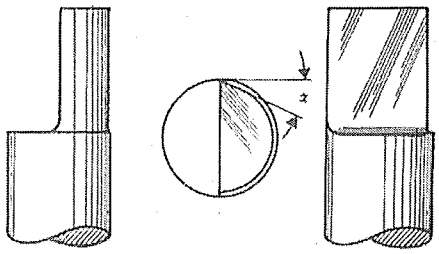


Fig. 1

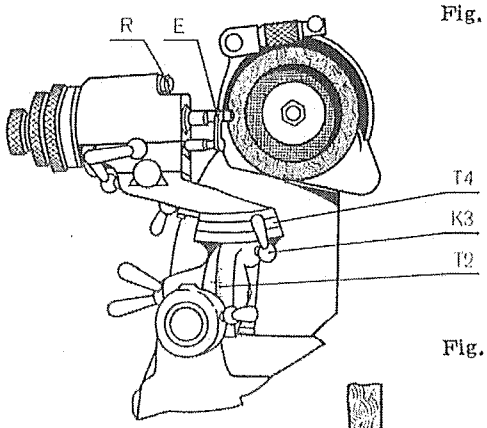


Fig. 2

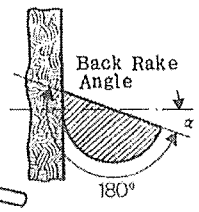


Fig. 3a

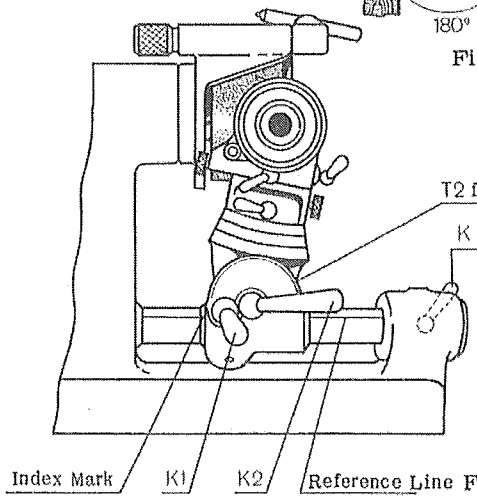


Fig. 3

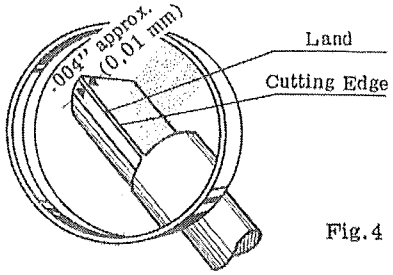


Fig. 4

Circular Grinding of Cutters –

Grinding the Back Rake Angle of End Cutting Edges (Straight)

SO

The end cutting edge illustrated in Fig.1 may be ground in an operation immediately following the grinding of the side cutting edge; or it may be ground independently. In the latter case the cutter will have to be aligned by means of gauge E and clamped in position. Whenever a single-lip cutter is to be ground, the aligning gauge will have to be used, as one leg of the cutting angle is formed by the cutting lip surface. The back rake angle should be selected to suit the material to be cut (see page 10).

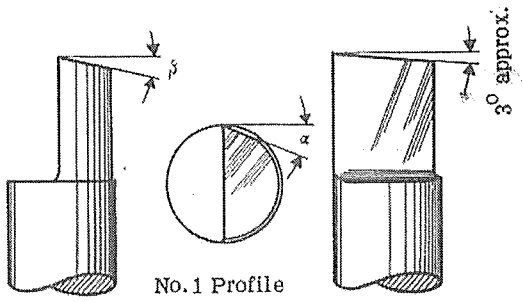


Fig.1

1 Setup Operations

1. Engage index pin R into central hole; bring red dot into window U.
2. Release clamping lever K2; using setting scale T2, set swivel arm at 3° approx.; tighten clamping lever K2.
3. Release clamping levers K3 and K4; hold index drum T4 against stop and, beginning at 90°-position, set swivel arm at desired angle; for example set arm at 75° for back rake angle of 15°. (See Fig. 2 and 3). Tighten clamping levers K3 and K4
4. Tighten clamping lever K; release lever K1; shift work fixture on tubular rail to bring cutter into light contact with grinding wheel. Align index mark of vertical swivel mount with reference line on tubular rail; tighten clamping lever K1; release lever K.

Grinding the Back Rake Angle

5. Fine adjustment screw F serves to set the index head laterally relative to the wheel and to set the work for the desired depth of cut. – It is also possible to produce the desired back rake by holding the cutter against the circumference of the grinding wheel as is shown in Fig.4.

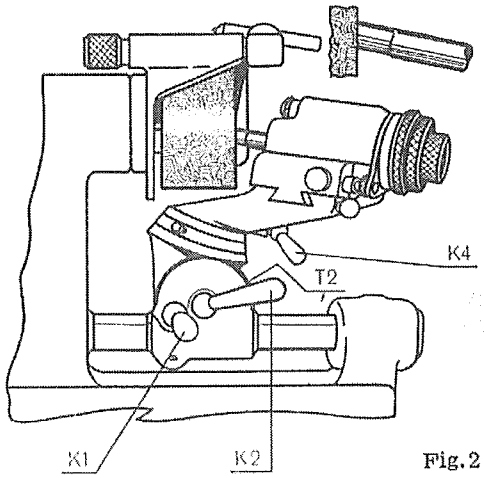


Fig.2

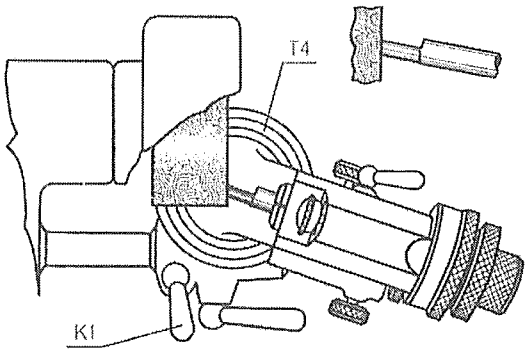


Fig.3

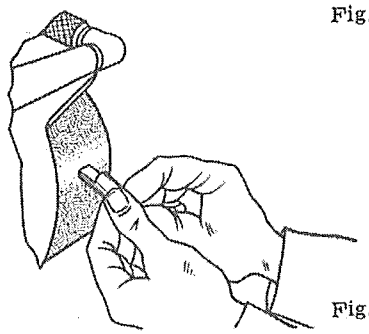


Fig.4

Circular Grinding of Cutters –

Grinding the Back Rake Angle of End Cutting Edges (Round)

Cutter profiles having either on-center or off-center radii are derived from cylindrical single-lip cutters having a straight end cutting edge by rounding off the corner as shown in Figs. 2 and 3 (Nos. 2 and 3 Profiles).

In rounded cutters of this type the back rake angle of the side cutting edge is the same as that of the end cutting edge. For this reason it is necessary, during grinding the end rake angle, that the work fixture is set at the side rake angle by means of setting scale T2. If the end cutting edge is ground immediately after grinding the side cutting edge, it will not be necessary to re-set the work fixture and to re-align the cutting lip by means of gauge E.

Setup Operations

1. Engage index pin R into left-hand hole; bring red dot into window U.
2. No.2 Profile: Release Clamping Lever K5; rotate knurled knob S5 to set cross slide by means of vernier scale T5 for desired radius (to the right); tighten clamping lever K5, see Fig. 2. As the radiused corner is required to be tangent to the cutter diameter, the amount of off-set a is D/2 – r.
   Example:
   Given r=.06"(1,5 mm); D=.30"(8 mm)
   a=.15"(4 mm)–.06"(1,5 mm)=.09"(2,5 mm)

2a. No.3 Profile: The vernier scale T5 of the cross slide must be set at zero (see Fig.3).

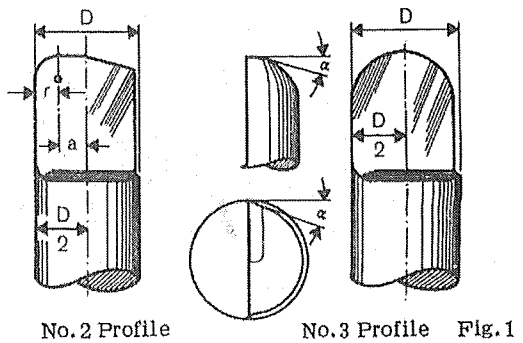
3. Rotate fine adjustment screw F to bring the side cutting edge of the cutter into light contact with the face of the grinding wheel. Caution: Do not injure the land of the side cutting edge. Now screw F must no longer be rotated.

Grinding the Back Rake Angle

4. Swivel index head through 90° (see Fig. 4); Depth of cut adjustment now is by longitudinal slide L. Fine adjustment is by micrometer screw S6 of the longitudinal slide with adjustment screw D6 tightened. The end of the cutter is rounded by slowly swiveling the index head back to its original position, while the collet bearing is continuously rotated back and forth between the stops, the rotation being through 180°. (See Figs. 5 and 6). Prior to grinding, be sure to withdraw the index head a slight amount by rotating screw S6 in order to prevent overheating of the cutter by excessive stock removal. After each pass of the grinding wheel the cutter is then fed towards the whed by means of screw S6.

In order to obtain a satisfactory cutting edge it is advisable, as a final operation, to swivel the index head through 90° with the cutter lip pointing vertically upward.

In cases where cutters given a No.3 profile are intended for the machining of hard steel which requires a small back rake angle, it is good practice to flatten the curvature of the cutter by a manual grinding operation as shown in Fig.7.



No.2 Profile No.3 Profile Fig.1

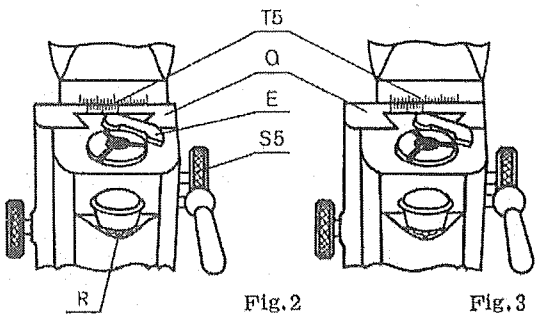


Fig.2 Fig.3

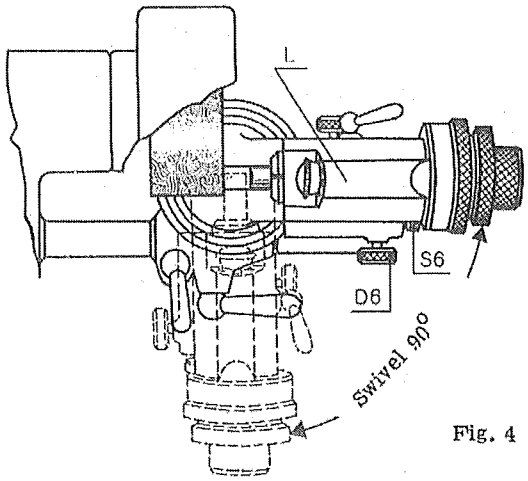


Fig. 4

Fig.5 Fig.6

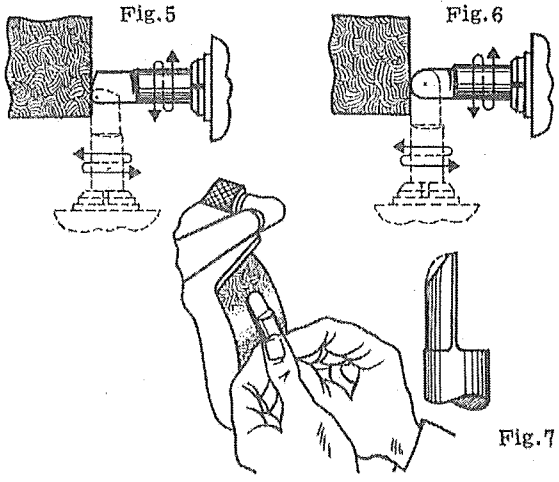


Fig.7

Where pointed cutters are concerned, both the included angle of the point and the back rake angle are produced in one operation (see Fig. 1). The back rake angle should be selected to suit the material to be cut (see page 10).

Setup Operations

1. Engage index pin R into central hole; bring red dot into window U.
2. Align cutter lip by means of gauge E; grip cutter in position; return gauge E;
3. Engage index pin R into left-hand hole to enable collet bearing to be rotated 180° between stops.
4. Release clamping levers K3 and K4; hold index drum T4 against stop and, beginning at zero position, set swivel arm at one-half the desired point angle (see Fig. 2).

   Example: Given a point angle of 60°. Set swivel arm by index drum T4 at 30°. Retighten clamping levers K3 and K4.
5. Release clamping lever K2; set work fixture for desired back rake angle by means of setting scale T2, see Fig. 3. Thighten clamping lever K2.
6. Tighten clamping lever K; release lever K1; shift work fixture on tubular rail to bring cutter into light contact with grinding wheel. Align index mark of vertical swivel mount with reference line on tubular rail; tighten clamping lever K1; release lever K.

Grinding the Back Rake Angle

7. During grinding, slowly return stop screw G to advance the work fixture past the wheel; at the same time continuously rotate the collet bearing back and forth between the stops, the rotation being through 180°. This ensures uniform stock removal (see Figs. 4a, b, c). Uniform stock removal will protect the cutter from overheating.

Whet the cutter point by means of an oil stone. It is advisable to whet the point as far as engraving conditions permit. This operation will give the point a small end cutting edge which will participate in removing stock (see Fig. 5). However, where hairline engraving work is concerned (depth of cut not exceeding .0004" 0,01 mm), the shape of the point should not be changed; only the cutting edge proper should be carefully whetted.

In addition it is recommended to whet also the cutting lip by means of an oil stone in order to remove burrs. However, care should be exercised not to remove noticeable amounts of stock from the cutting lip, as this would destroy the centering of the lip; moreover, this would render a greater or lesser part of it useless. When grinding the cutting lip for the first time, care has to be taken to grind with a positive tolerance.

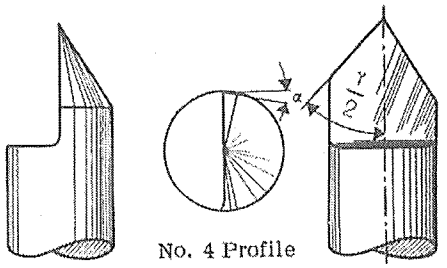


Fig. 1

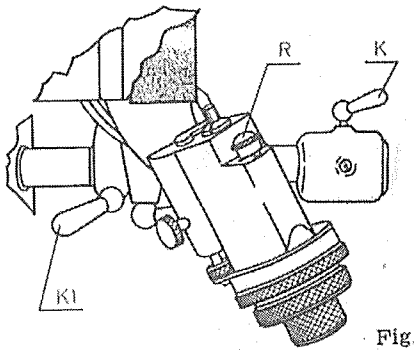


Fig. 2

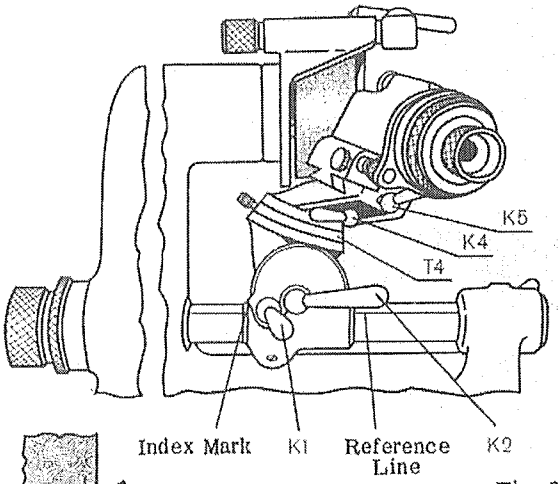


Fig. 3

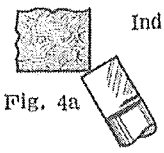


Fig. 4a

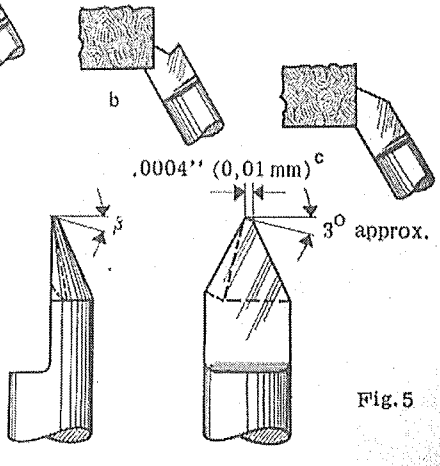


Fig. 5

SO

Grinding Tapered Cutters –

(A) Circular Grinding of Side and End Cutting Edges

Tapered cutters can be ground to size in the machine without the use of any measuring instrument, exept for the scales provided on the machine. For circular grinding operations on profiled cutters follow this procedure;

Setup Operations

1. Engage index pin R into central hole; bring red dot into window U.
2. Align cutter lip by means of gauge E; grip cutter in position; return gauge E.
3. Engage index pin R into right-hand hole to enable collet bearing to be rotated through 360°. Release clamping levers K2, K3, K4. Set scales T2 and T4 at zero. Tighten clamping levers K, K2, K3, K4, see Fig.4.
4. Release clamping lever K1; bring cutter diameter into light contact with grinding wheel; tighten clamping lever K1, taking care to keep index mark of vertical swivel mount aligned with reference line on tubular rail; release clamping lever K, see Fig.4.
5. No. 5 profile (Figs. 1 and 2): Release clamping lever K5; rotate knurled knob S5 to shift cross slide to the right by one-half of the diameter of the taper (a in Fig. 1); for this purpose use cross slide vernier scale T5. Tighten clamping lever K5.

5a. No.6 profile (Figs. 1 and 2): Release clamping lever K5; rotate knurled knob S5 to shift cross slide to the right by the desired amount "a" (use cross slide vernier scale T5. Tighten clamping lever K5.

5b. No.7 profile (Figs. 1 and 3): Set cross slide vernier scale at zero.

6. Nos.5 and 7 profiles: Rotate fine adjustment screw F to bring cutter diameter into light contact with grinding wheel; Again rotate screw F to shift cutter to the left by amount $x = \frac{D}{2} - a$. To facilitate this setting operation, set scale drum of screw F at zero without disturbing the setting of the screw (see Fig.4).

6a. No.6 profile: Rotate screw F to bring cutter diameter into light contact with grinding wheel; again rotate screw F to shift cutter to the left by the amount $x = \frac{D}{2} - (a + r)$. To facilitate this setting operation, set scale drum of screw F at zero without disturbing the setting of the screw (see Fig. 4).

7. Release clamping lever K3; rotate swivel arm through 90°; release clamping lever K6; rotate longitudinal slide micrometer screw S6 to advance end face of cutter towards grinding wheel. Where tapered cutters are to be resharpened, the length of the cutting edge at the end of the cutter should be made greater than the small diameter of the tapered portion.

8. Release clamping lever K4; hold index drum T4 against its stop and, counting from the zero position, set swivel arm at the desired taper angle; tighten clamping levers K3 and K4, see Fig. 5.

Circular Grinding

9. No.5 profile: Slowly return stop screw G and continuously rotate the collet bearing through 360° to advance the cutter past the grinding wheel. Prior to the circular grinding operation rotate fine adjustment screw F to shift the cutter to the right; then advance the cutter towards the wheel by small increments until the desired size has been obtained (see Fig.6).

9a. Nos.6 and 7 profiles: Release clamping lever K3; first slowly return stop screw G, then slowly swing the swivel arm while continuously rotating the collet bearing through 360° to move the cutter past the wheel and thus to circular grind both the taper and the radius. Prior to the circular grinding operation rotate fine adjustment screw F to shift the cutter to the right; then advance the cutter towards the wheel by small increments until the desired size has been obtained (see Figs. 7 and 8).

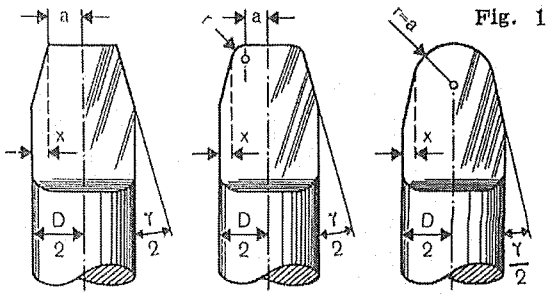


Fig. 1

No. 5 Profile No. 6 Profile No. 7 Profile

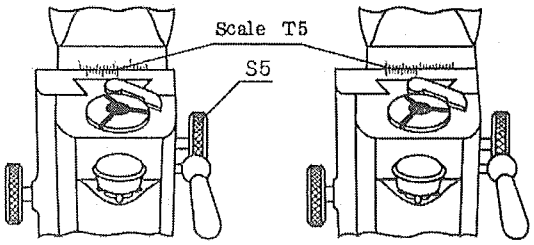


Fig. 2 Fig. 3

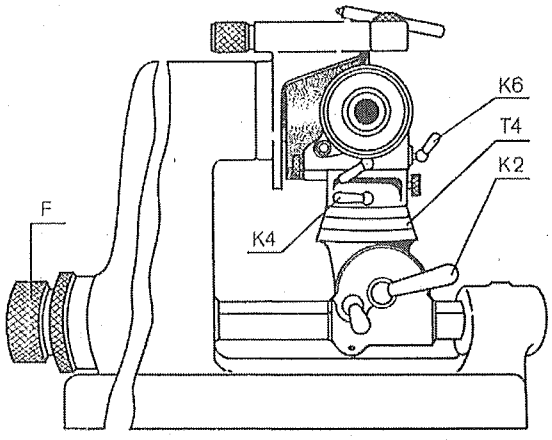


Fig. 4

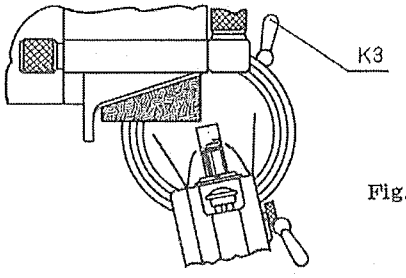
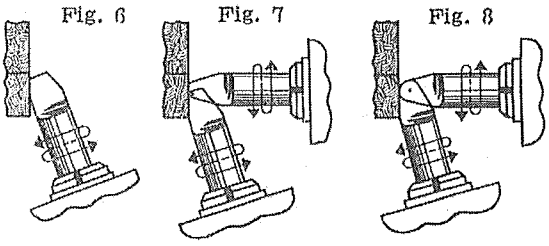


Fig. 5

Fig. 6 Fig. 7 Fig. 8



Grinding Tapered Cutters –

(B) Grinding the Back Rake Angle of Side and End Cutting Edges (Straight)

The back rake angles of the side and end cutting edges may be ground immediately after circular grinding the desired cutter profile; or in cases where only the taper angle (not, however, the small diameter of the tapered portion) is of importance, grinding may be performed in an independent operation. Where the small taper diameter must be held within close tolerances, only the end cutting face will be ground; in this case the cutter will have to be aligned by means of gauge E and clamped in position. The back rake angles of the side and end cutting edges should be selected to suit the material to be cut (see page 10). For tool angles refer to Fig. 1.

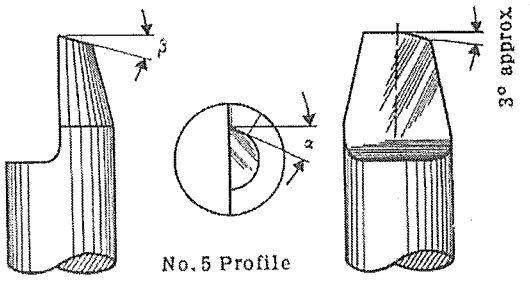


Fig. 1

Grinding the Side Cutting Edge

Setup Operations

1. Engage index pin R into left-hand hole; bring red dot into window U.
2. Release clamping lever K2; using scale T2, set cutter at desired back rake angle; tighten clamping lever K2, see Fig. 2.
3. Tighten clamping lever K; release lever K1; shift work fixture on tubular rail to bring cutter into light contact with grinding wheel; tighten clamping lever K1, taking care to keep index mark of vertical swivel mount aligned with reference line on tubular rail; release clamping lever K.

Grinding the Back Rake Angle

4. While continuously rotating the collet bearing through 180° (back and forth between the stops), advance the cutter towards the grinding wheel by means of fine adjustment screw F. This will produce the desired back rake angle in a positively controlled operation (see Fig. 2).

   Upon completion of the grinding operations on the side cutting edge, a very narrow land must remain at the edge.

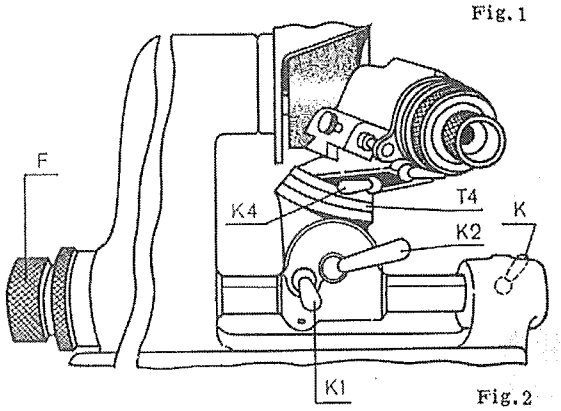


Fig. 2

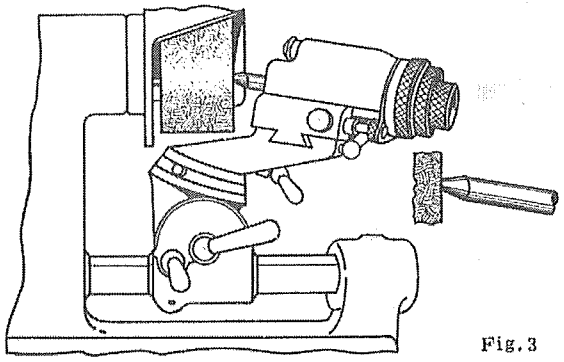


Fig. 3

Grinding the End Cutting Edge

Setup Operations

1. Engage index pin R into central hole; bring red dot into window U.
2. Release clamping lever K2; using scale T2, set swivel arm at an angle of 3° approximately; tighten clamping lever K2, see Fig. 3.
3. Release clamping levers K3 and K4; hold scale T4 against its stop and, beginning at the 90° -position, set swivel arm at the desired angle; for example, where an angle of 10° is desired, the swivel arm will have to be set at 80°. Tighten clamping levers K3 and K4, see Fig. 4.
4. Tighten clamping lever K; release lever K1; shift work fixture along tubular rail to bring end face of cutter into light contact with grinding wheel; tighten clamping lever K1, taking care to keep index mark of vertical swivel mount aligned with reference line on tubular rail; release clamping lever K.

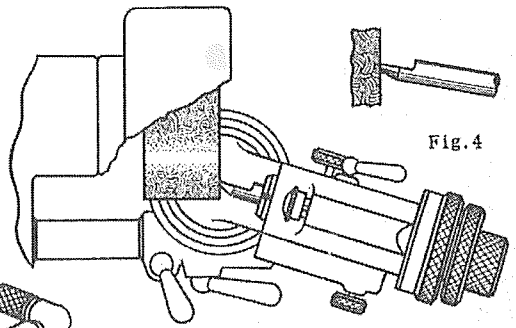


Fig. 4

Grinding the Back Rake Angle

5. Lateral fine adjustment of the work fixture relative to the grinding wheel and adjustment for depth of cut is obtained by means of screw F. It is also possible to grind the back rake angle manually; care should, however, be taken to produce the correct tool angles (see Fig. 5).

In cases where close tolerances on the small taper diameter after grinding the end cutting edge are prescribed, the corner of the side cutting edge will have to be maintained; this will make it possible to check whether or not the small taper diameter was changed during grinding operations (see Fig. 6).

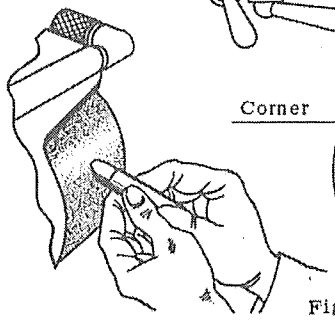


Fig. 5

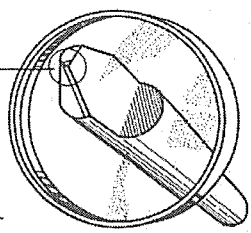


Fig. 6

Grinding Tapered Cutters –

(C) Grinding the Back Angle of Side End Cutting Edges (Round)

Tapered cutters having either an off-center or an on-center radius can be given a back rake angle only in connection with the circular grinding operation (see Fig. 1). The back rake angle of the side cutting edge equals that of the straight or rounded end cutting edge; the proper angle to be used will be found in page 10. After tapered cutters with rounded end cutting edges have become dull, first proceed with the circular grinding operation described in page 16; then follow the procedure indicated below.

Setup Operations

1. Engage index pin R into left-hand hole; bring red dot into window U.
2. Release clamping lever K2; use scale T2 to set work fixture at desired back rake angle; tighten clamping lever K2.
3. Tighten clamping lever K; release lever K1; shift work fixture along tubular rail to bring cutter into light contact with grinding wheel; tighten clamping lever K1, taking care to keep index mark of vertical swivel mount aligned with reference line on tubular rail; release clamping lever K, see Fig. 2.

Grinding the Back Rake Angle

4. While continuously rotating the collet bearing through 180° (back and forth between the stops), advance the cutter towards the grinding wheel by means of fine adjustment screw F. This will produce the desired back rake angle on both the side and the end cutting edges in a positively controlled operation (see Figs. 3, 4, 5).

   Upon completion of grinding operations a very narrow land must remain at the cutting edge.
5. In cases where the cutter is intended for the machining of hard steel which requires a small back rake angle, it is advisable to grind off part of the curvature in a manual operation (see Fig. 6).

In addition it is recommended, with regard to all single-lip cutters, to whet also the cutting lip by means of an oil stone in order to remove burrs. However, care should be exercised not to remove noticeable amounts of stock from the cutting lip, as this would destroy the centering of the lip; moreover, this would render a greater or lesser part of it useless.

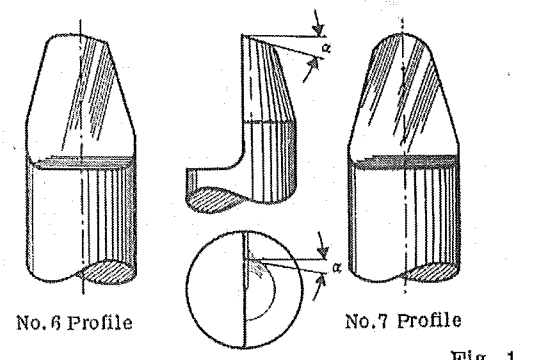


Fig. 1

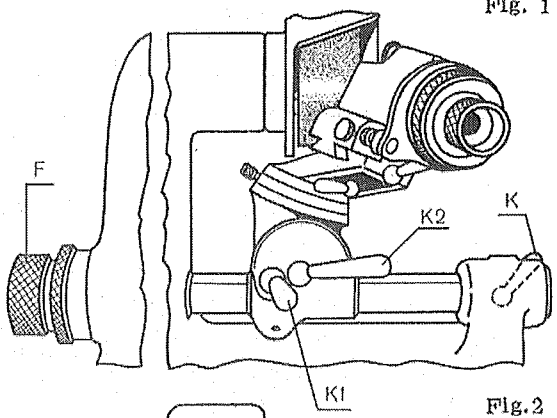


Fig. 2

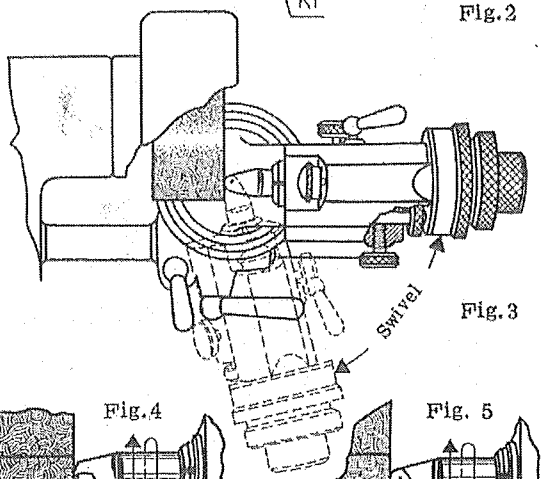


Fig. 3

Fig. 4

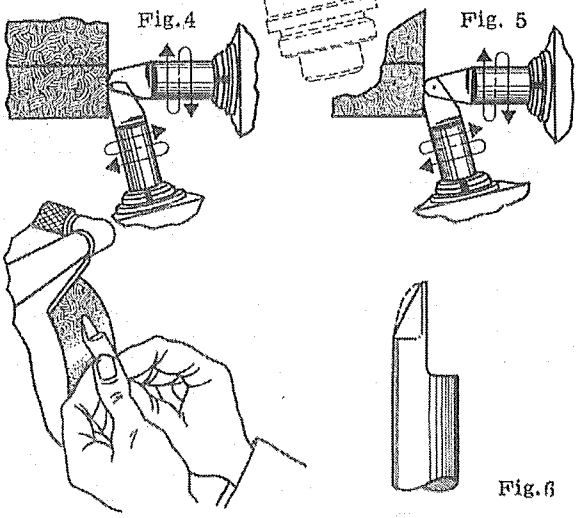


Fig. 5

Fig. 6

Standard Equipment

Quantity	Name	Stock No.
1	Hexagon Socket Screw Wrench	DIN 911–5
1	Hexagon Socket Screw Wrench	DIN 911–6
2	Hook Spanner	DIN 1810–30x32
1	Hexagon Box Wrench	GZS–B 809a
1	Ring Nut Wrench	SZS–B 203a
2	Pin Spanner	GZS–B 116
1	Grinding Wheel Mount, installed	5260 30 120
1	Tapered Cup Wheel, made of special fused alumina, for grinding HSS2, HSS3 and HSS5 single-lip cutters	SZSch–605 100
2	Spring Collets	FZZ–20.02
1	Drive Cord for Motor	MB–239
1	Drive Cord for Blower	MB–244
1	Instruction Book	

Special Equipment

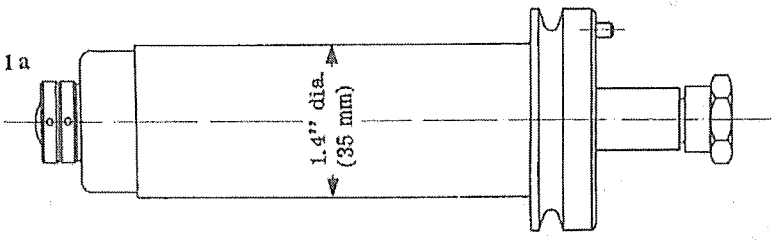
Quantity	Name	Stock No.
1	Stand	
1	Dust Removal Equipment	
1	Machine Lamp	5250 0201
1	Diamond, in tip	SN–324
1	Special Index Head	5001 40 33
1	Spindle Assembly Locating Fixture	
1	Silicon Carbide Cup Wheel for rough-grinding cemented carbide single-lip cutters C3	SZSchV–605 100
1	Diamond Cup Wheel for finish-grinding cemented carbide single-lip cutters C4	SZSchF–605 100
1	Taper Sleeve, G1-taper	FZZ–261
1	Taper Sleeve, G2-taper	FZZ–262
1	Taper Sleeve, GA-taper	FZZ–263
1	Diamond File	SZD–B 101
1	Tube of Grease Isoflex Super TEL	

In order to facilitate our prompt filling of orders for replacement parts and to eliminate delays, customers are requested to state machine model and serial numbers. These data will be found on the nameplate attached to the upper front of each machine. It is good practice also to state the page of the instruction book or spare parts list on which the part in question is shown and its nomenclature indicated.

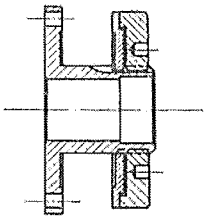
Customers may also state the model and serial numbers and forward to Deckel either the damaged part or a diagram showing the main dimensions.

Spindle Assembly SO-T41a

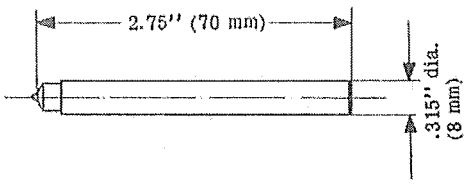
In view of high accuracy requirements, only complete spindle assemblies are available.

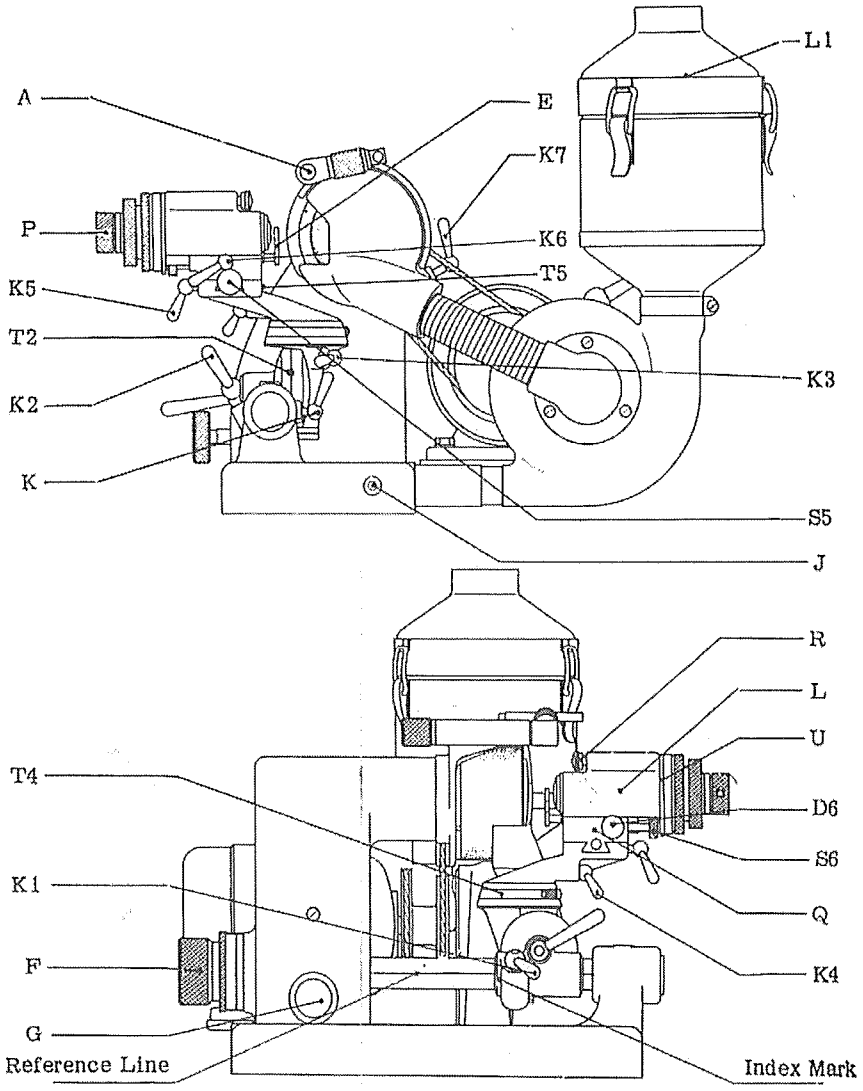


Grinding Wheel Mount
5260 30 120
for receiving the grinding wheels



Diamond Holder SOVD
with or without diamond





A Wheel Dressing Attachment
P Spring Collet Clamping Quill
K 5 Cross Slide Clamping Lever
T 2 Vertical Swivel Mount Setting Scale
K 2 Index Drum T2 Clamping Lever
K Tubular Rail Clamping Lever
T 4 Horizontal Swivel Mount Index Drum
K 1 Vertical Swivel Mount Clamping Lever
F Index Head Bracket Fine Adjustment Screw
G Adjustable Stop Screw
L 1 Air Filter
E Cutter Lip Aligning Gauge
K 7 Mouthpiece Clamping Lever
K 6 Longitudinal Slide Clamping Lever
T 5 Cross Slide Vernier Scale for Off-Center Radii
K 3 Horizontal Swivel Mount Clamping Lever
S 5 Cross Slide Adjustment Screw
J Hexagon Socket Screw for Adjusting Blower Cord Tension
R Spring Collet Index Pin
L Longitudinal Slide
U Red Dot Widow
D 6 Index Head Slide Fine Adjustment Screw
S 6 Longitudinal Slide Micrometer Screw
Q Cross Slide
K 4 Index Drum T4 Clamping Lever